STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME I

QUALITY ASSURANCE PLAN

MONITORING AND LABORATORY DIVISION

JUNE 2005

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1.0.0 INTRODUCTION

This six-volume series, entitled the Quality Assurance Manual, describes the Air Resources Board's (ARB) Quality Assurance Program. The volumes have been revised and amended to include federal regulations presented in the Code of Federal Regulations, Title 40 - Protection of the Environment, Part 58, Ambient Air Quality Surveillance (July 1, 1990), hereafter referred to as 40 CFR Part 58. The volumes serve as guidance documents for the operation of quality assurance programs used by the ARB, local districts, and private industry. The volumes are intended for field operators and supervisors; laboratory, data processing, and engineering personnel; and program managers responsible for implementing, designing, and coordinating air quality monitoring projects.

Unless otherwise identified by paragraph heading, the bulk of the procedures in this volume apply to the criteria pollutants. This volume covers the quality assurance overview for criteria pollutants, toxic air pollutants, acid deposition, and meteorological parameters.

Current quality assurance methods and procedures are grouped and presented as follows:

Volume I	Quality Assurance Plan
Volume II	Standard Operating Procedures for Air Quality Monitoring
Volume III	Laboratory Methods and Operations
Volume IV	Air Quality Data Processing (not available)
Volume V	Audit Procedures Manual
Volume VI	Standard Operating Procedures for Stationary Source Emission Monitoring and Testing

Whereas Volumes II through VI present detailed procedures, Volume I presents the basic overview of the ARB Quality Assurance Program. Each section of Volume I deals with a unique yet interrelated topic. Our intent is to present information in Volume I which will help define and clarify the many issues involved in maintaining an effective quality assurance program. Comments concerning any volume of the series are encouraged and should be submitted to the Quality Assurance Section of the ARB.

1.0.1 POLICY AND OBJECTIVES

1.0.1.1 POLICY - It is the policy of the Air Resources Board (ARB) to support and conduct appropriate quality assurance activities to ensure that the objectives stated below are met.

1.0.1.2 OBJECTIVES - The overall objectives of the ARB Quality Assurance Program are:

1. To provide accurate and precise data to meet the ARB's monitoring objectives by controlling air monitoring through the implementation of procedures, policies, specifications, standards, and corrective measures;

2. To minimize loss of air quality data due to malfunctions; and

3. To assess the quality of the air monitoring data to provide representative and comparable data of known precision and accuracy.

   NOTE: Data quality objectives have not yet been established for non-criteria pollutants.

Air quality data accuracy and precision estimates are calculated and reported each calendar quarter and each calendar year in accordance with 40 CFR Part 58 regulations. For the ARB, objectives for criteria pollutants for a calendar year are:

1. Accuracy - Based on ARB performance audits, air quality data shall be within ±15 percent of true value, with the exception of the PM10 flow data, which shall be within ±10 percent of the true value. Photochemical Assessment Monitoring Stations (PAMS) and Motor Vehicle performance audits shall be within ±20 percent for each component. For NOX analyzers, the converter efficiency shall be equal to or greater than 96.0 percent. Quarterly reported 95 percent probability limits for the reporting organization shall be less than 20 percent.

2. Precision - Based on ARB checks performed at least five days/week, air quality precision data shall be within ±15 percent of true value. Quarterly reported 95 percent probability limits for the reporting organization shall be less than 20 percent.

3. Data Capture - In addition, the ARB shall strive to obtain at least 85 percent data capture, while maintaining the precision and accuracy objectives. Data capture (DC) for a single pollutant at a single site (SS) is defined as:

$$\%DC = \frac{\text{(total number of) (hours possible)} - \text{(hours lost to) (calibration)} - \text{(hours lost to) (downtime)}}{\text{total number of hours possible}} \times 100$$

The relevant time periods (day, month, quarter, year) for determining data completeness are covered in Table 1.0.1.1.

Data capture for the reporting organization* (RO) for a single pollutant shall be defined as:

$$\%DC_{RO} = 1/n \sum_{i=1}^{n} \%DC_{SSi}$$

Where n = the number of stations reporting

4. Representativeness - Spatial and temporal data representativeness shall be achieved by assuring that criteria are met for station siting as defined in federal regulations, and that air quality measurements and statistics are complied as listed in Table 1.0.1.1. In general, statistics are considered representative if 75 percent of the possible short-term values are included and are distributed throughout the entire statistical time period.

5. Completeness- Data for a site will be complete if there are representative data (as determined in accordance with Title 17, California Code of Regulations, Section 70306, Appendix 1) during the required hours of the day during the required months for the required years. The purpose of these data completeness criteria is to specify the minimum data necessary to assure that sampling occurred at times when a violation is most likely to occur.

6. Comparability- Data comparability shall be achieved through the use of uniform procedures and Environmental Protection Agency designated reference or equivalent methods Statewide.

* Reporting organizations are defined and designated in Section 1.0.2.

Table 1.0.1.1 Data Completeness Criteria
ARB Air Monitoring Quality Assurance Manual,
Volume I (Quality Assurance Plan)
CRITERIA FOR REPRESENTATIVENESS OF AIR QUALITY MEASUREMENTS AND STATISTICS FOR CRITERIA POLLUTANTS*

Representative Calendar Statistic	Sampling Time Period	Basis of Statistic of Requirement	Number of Representative Periods Required
Year	Any		Four representative calendar quarters
Quarter	24- Hour	Based on daily sample	Three representative months
	Less than 24- Hour	Based on daily statistic	69 or more representative calendar days
		Based on hourly samples	1643 or more hours
Month	24- Hour	Based on one sample every 6 days	4 or more 24-hour samples
		Based on one sample every 3 days	8 or more 24-hour samples
	Less than 24- Hour	Based on daily statistic	23 or more representative calendar days
		Based on hourly samples	548 or more hours
		Based on all 2-hour samples	274 or more 2-hour samples
		Based on all 3-hour samples	183 or more 3-hour samples
Day	1- Hour		6 or more hours in each 1/3 day (hours 0 through 7, 8 through 15, 16 through 23) and missing no more than 2 consecutive hourly samples
	2- Hour	Based on all 2-hour samples	9 or more samples
	3- Hour	Based on all 3-hour samples	6 or more samples
	24- Hour	Based on daily sample	22 but no more than 26 hours of sampling

	N	Number of Samples Needed
Mean of N Hour Period	24	18 or more hourly samples
	8	6 or more hourly samples
	6	5 or more hourly samples
	4	3 hourly samples
	3	3 hourly samples
	2	2 hourly samples
	1	30 minutes or more of continuos sampling**

* Refer to Code of Federal Regulations, Title 40, Protection of the Environment, Part 58, Ambient Air Quality Surveillance (July 1996) for details. Representativeness criteria have not yet been established for measurement of acid deposition, toxic pollutants, and meteorological parameters. Applicable to gaseous and particulate criteria pollutants.

** Refer to Air Monitoring Quality Assurance, Volume II, Standard Operating Procedures for Air Quality Monitoring, California Air Resources Board, April 2000, Section 2.0.2.7

1.0.2 REPORTING ORGANIZATIONS

1.0.2.1 DEFINITION - A reporting organization is a federal term defined generally as a state or subordinate organization within a state which is solely responsible for a set of stations which monitor the same pollutant and for which precision and accuracy assessments can be pooled.

Each reporting organization shall be defined such that precision and accuracy among all stations in the organization can be expected to be reasonably homogeneous as a result of common factors. Common factors include: (1) operation by a common team of field operators, (2) common calibration facilities, and (3) support by a common laboratory or headquarters.

1.0.2.2 DESIGNATION - In the State of California, there are four reporting organizations for federal purposes. These reporting organizations are:

1. Air Resources Board (ARB) (#06-001)

2. Bay Area Air Quality Management District (#06-004)

3. San Diego County Air Pollution Control District (#06-036)

4. South Coast Air Quality Management District (#06-061)

The ARB reporting organization consists of ARB and all air pollution control districts in the State of California, except the Bay Area Air Quality Management District, San Diego County Air Pollution Control District, and South Coast Air Quality Management District.

1.0.2.3 RESPONSIBILITIES - Each reporting organization shall be responsible for maintaining their own quality assurance programs and reporting their precision and accuracy data to the United States Environmental Protection Agency (U.S. EPA). Each agency's standard operating procedures for air monitoring (Quality Assurance Manuals) have been reviewed and approved by the U.S. EPA. In order to ensure data continuity between reporting organizations, ARB conducts periodic interlaboratory standards comparisons, system audits, and performance audits.

Each agency within the ARB reporting organization has the primary responsibility for ensuring that air quality data are collected in sufficient quantity and of sufficient quality to meet the objectives outlined in Section 1.0.1. Unless alternative procedures are submitted in writing to, and approved in writing by the ARB Monitoring and Laboratory Division, the procedures set forth in the ARB Air Monitoring Quality Assurance Manual (Volumes I through VI, as developed) apply to all agencies within the ARB reporting organization and serve as a model for the other district reporting organizations (South Coast AQMD, Bay Area AQMD, and San Diego APCD). The ARB in effect has technical jurisdiction over all districts via the State Board's approval of the districts' attainment plans. The legal provisions covering the relationship between the ARB and the districts are specified in the California Air Pollution Control laws.

1.0.2.4 DISTRICT QUALITY ASSURANCE REQUIREMENTS - The ARB maintains a close relationship with local air pollution control districts in working towards the common goal of quality air monitoring data. The ARB has the primary responsibility to oversee quality assurance throughout the State, while local districts are responsible for their respective air monitoring programs.

The ARB assists local districts in upgrading their quality assurance programs by providing technical assistance. The technical assistance covers: equipment purchase recommendations, analyzer evaluation and repair, analyzer calibrations, interlaboratory comparisons, training, equipment loans, and formalized reviews of air monitoring programs in the form of system audits. Emphasis is placed on developing and maintaining minimum standards of quality assurance in air monitoring consistent with State and federal guidelines.

The following criteria pollutant guidelines are presented as an aid to the districts in evaluating the quality and reliability of their own air monitoring programs. These guidelines are to be used to ensure data acceptability prior to entry in the ARB data bank.

1. Instrumentation used to measure ambient air quality of criteria pollutants shall be designated reference or equivalent method by the U.S. EPA and/or the ARB. Federally approved methods are not automatically deemed usable for State standard attainment purposes.

2. Calibration and operating procedures shall be documented and found

acceptable to the ARB. This shall include zero, span, and precision checks; preventative and remedial maintenance; and documentation of quality control information.

3. Automated instrumentation shall be housed in temperature controlled shelters. The shelter temperature shall be maintained at 25°C $\pm$ 5°C. However, the U.S. EPA allows a low of 18°C with no more than a +10°C fluctuation (energy savings).

4. A sampling site report shall be submitted for each air monitoring station. A revised site report shall be submitted each time a change is made in the instrumentation, or type, or location of the sampling train, and/or whenever there is a change in the surrounding area that may affect the representativeness of the air quality data. (This may include a local construction project or start up or shut down of a significant local source, etc.) The site report shall consist of the following:

   a. The Site Initiation/Termination Report (form MLD-87),

   b. The Site Identification Report (form MLD-4),

   c. The Probe/Sampler Identification Report (form MLD-5),

   d. The Pollutant/Project Report (form MLD-6) for each pollutant monitored, and

   e. A map identifying the site location, UTM coordinates, and photographs at four major quadrants.

   In addition, districts are required to conform to other various quality assurance requirements as contained in 40 CFR Part 58 and as appropriate in the State's subvention grant agreements, such as the submission of quarterly precision data and participation in investigations of any required air quality data actions.

1.0.3 CALIFORNIA ARB ORGANIZATION

1.0.3.1 PERSONNEL - The organizational structure of ARB is shown in Figure 1.0.3.1. The Board's staff is divided among the Executive Office and seven divisions: Administrative Services, Compliance, Monitoring and Laboratory, Mobile Source, Research, Stationary Source, and Technical Support. Within the Monitoring and Laboratory Division, there are five branches: Air Quality Surveillance (AQS), Engineering and Certification (EC), Quality Management (QMS), Northern Laboratory (NL), and Southern Laboratory (SL). The organizational structure of the Monitoring and Laboratory Division (MLD) is shown in Figure 1.0.3.2.

The AQS Branch conducts most of ARB's continuous ambient air monitoring activities. Quality assurance procedures for these activities are covered in Volume II. As of December 2000, AQS was operating a total of 51 air monitoring stations. This includes 29 stations measuring more than one criteria pollutant and 19 stations measuring only one criteria pollutant, either ozone, or carbon monoxide, or PM10, and three stations measuring only non-criteria pollutants. Within the AQS network are contained 27 samplers monitoring 10 micron particulates by size selective inlet (PM10), 7 samplers monitoring 2.5 and 10 micron particulates by dichotomous samplers, 22 samplers monitoring coefficient of haze, 13 samplers measuring light scatter (nephelometer), 1 sampler monitoring wet acid deposition, 13 samplers monitoring 10 micron particulates by TEOM (Tapered Element Oscillating Microbalance), and 180 stations measuring meteorological parameters (wind speed and direction, relative humidity, and outside temperature). AQS also provides technical assistance to local districts. The Air Monitoring-North and Operations Support Section handles instrument repair, modifications, and retrofit, Statewide.

The AQS Branch's Statewide network has air toxic monitoring at 21 sites to collect population data (13 of these are district sites). Ambient samples of volatile and semi-volatile organic compounds and toxic metals are collected approximately twice monthly and analyzed by NLB. All fixed stations and mobile vans are operated by qualified station operators. In addition to operating the analyzers and reducing data, station operators also perform preventive maintenance and minor repairs on the analyzers. Instrument Technicians III provide technical assistance to station operators and perform the more difficult tasks related to station operations. Additionally, non-methane organic compounds (NMOC's) are measured seasonally at 7 sites every 3 days or less.

Short term or special purpose monitoring is also conducted using temporary and mobile air monitoring stations, and is managed by staff of the Special Purpose Monitoring and Data Support Section. This section's mobile monitoring vehicles can monitor for all ambient criteria and toxic pollutants. Section staff also support and operate the Board's Ambient Air Quality Data Acquisition System (AQDAS).

ECB consists of sections that develop test methods and conduct emission tests for air pollution from industrial sources. Quality control procedures for these activities are covered in Volume VI.

NLB handles organic and inorganic laboratory services, including filter weighings and analyses by atomic adsorption, x-ray fluorescence, gas and liquid chromatography, and ion chromatography. Samples analyzed include those containing lead, non-methane hydrocarbons, total metals, hexavalent chromium, aldehydes, and toxic air contaminants (i.e., benzene, butadiene, chloroform, carbon tetrachloride, trichloroethylene, etc.). Quality control programs and procedures for this laboratory are contained in standard operating procedures (Volume III).

The QM Branch consists of three sections: Program Evaluation and Standards (PE&S), Operations Planning and Assessment (OPA), and Quality Assurance (QA). The PE&S Section provides standards certifications and evaluation of current programs, while the QA Section conducts audits of air monitoring instruments, updates instrument operating procedures, and prepares and monitors quality control and quality assurance programs. The OPA Section is responsible for Board-wide issues

SLB performs organic and inorganic analysis, including chromatographic analysis of motor vehicle exhaust emissions and fuels, and infrared analyses. Quality control programs and procedures for this laboratory are contained in published standard operating procedures.

Other support for ARB's ambient air monitoring program is provided by the Air Quality Data Review (AQDR) and Meteorology Sections of the Planning and Technical Support Division. Members of the AQDR Section process, store, and report air monitoring data from ARB and district stations. In this processing operation, incoming air monitoring data are logged, a computer edit is performed, and the data are organized for publication. The Meteorology Section provides support in agricultural burning decisions and emergency episode management programs.

1.0.3.2 TRAINING - The ARB has recruitment and screening procedures to ensure that station operators are experienced and qualified instrument technicians. On-the-job training is completed by all new station operators before they are allowed to independently operate field stations.

Prior to installation of new instruments in the field, station operators attend training sessions. In these sessions, ARB specialists familiarize the operators with the function, maintenance, and troubleshooting of the new analyzers. ARB also provides support to the districts and other federal agencies in the State that may require training. Newly hired QA auditors receive on-the-job training from senior auditors on a continuing basis.

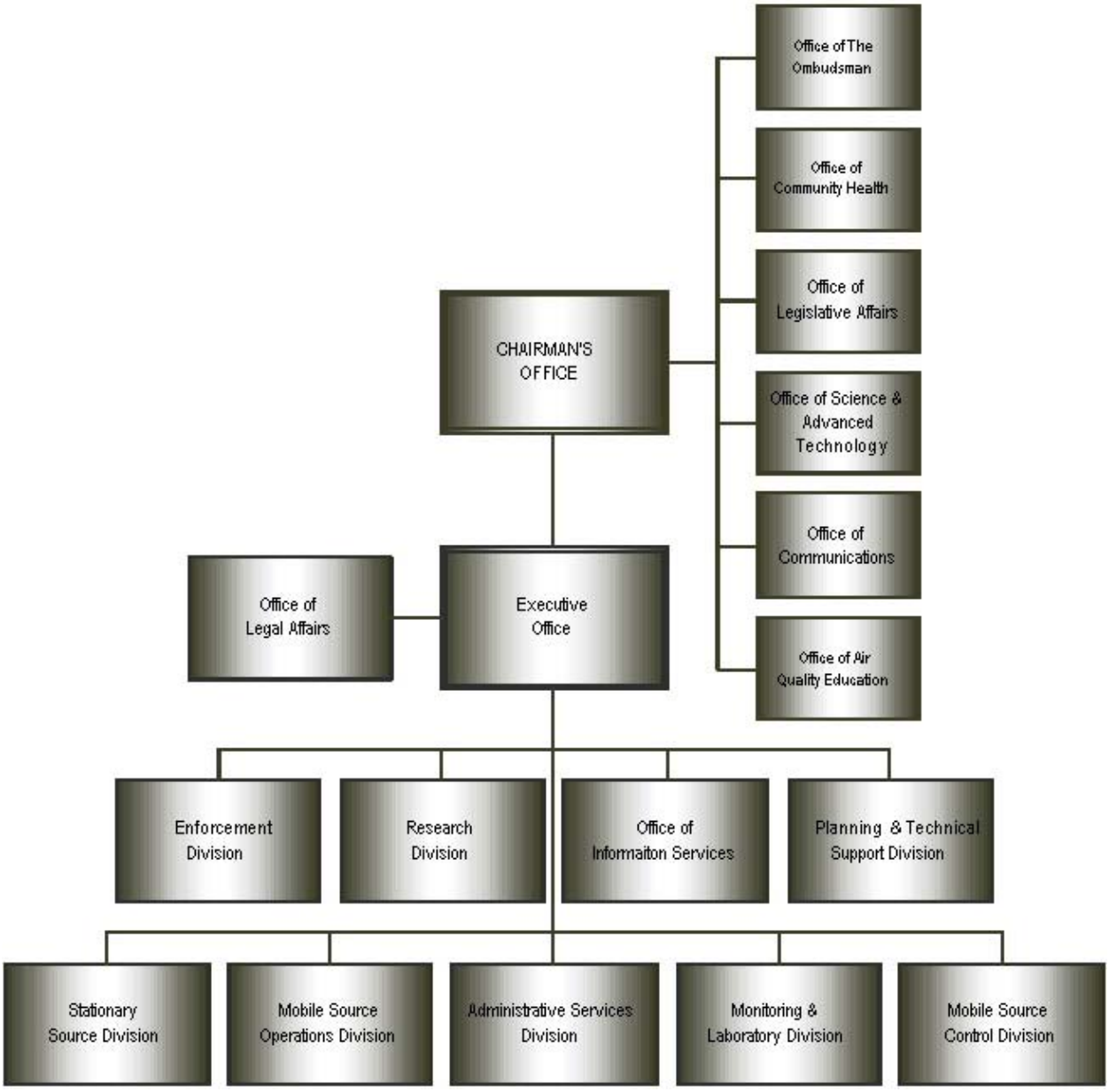


Figure 1.0.3.1
ARB Organization Chart

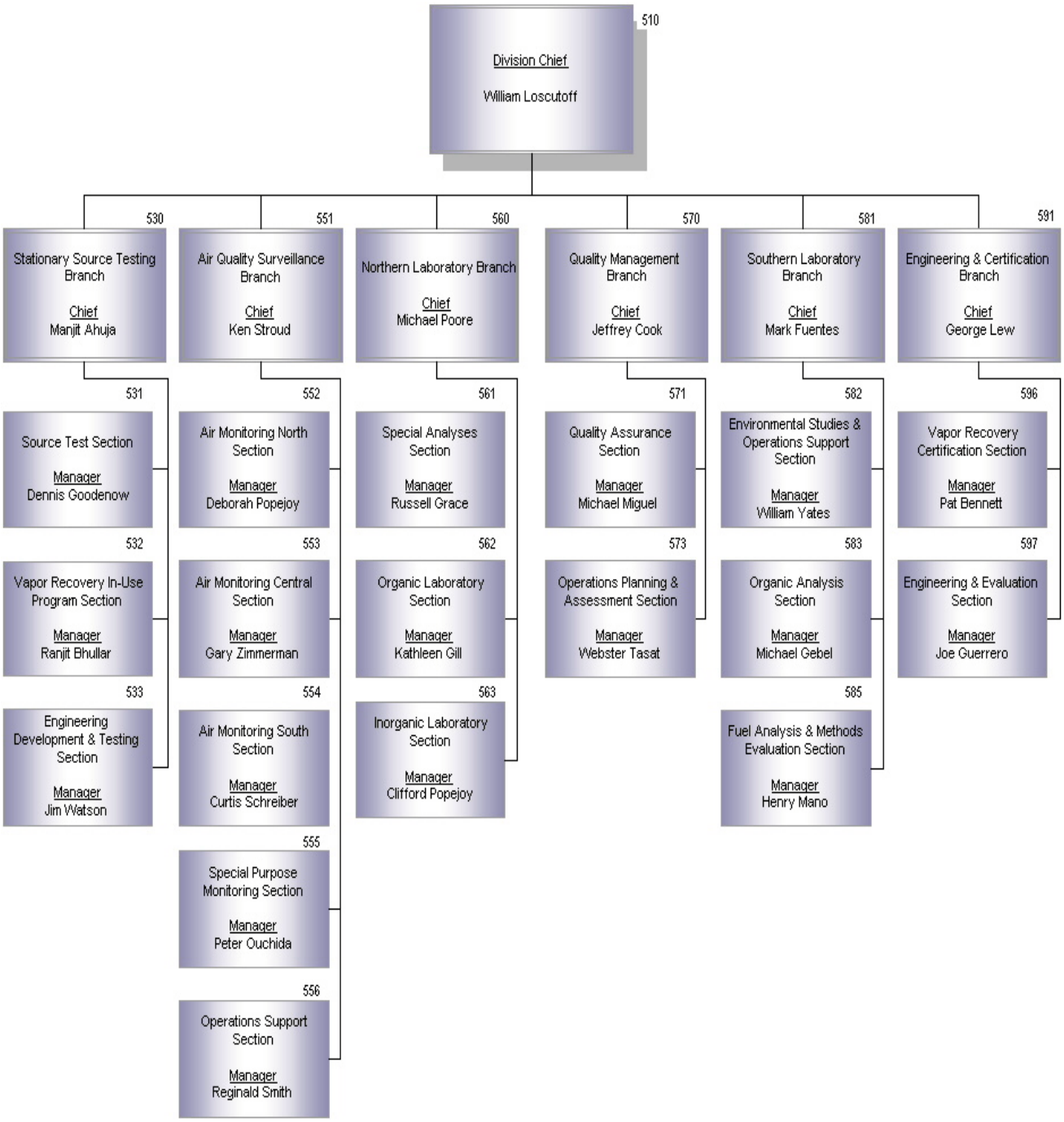


Figure 1.0.3.2
Monitoring and Laboratory Division Organizational Chart

1.0.4 QUALITY CONTROL AND QUALITY ASSURANCE

1.0.4.1 DEFINITIONS - Quality assurance is composed of two activities: quality control and quality assessment. Quality control is a set of internal tasks performed to provide accurate and precise measured ambient air quality data. The quality control tasks address sample collection, handling, analysis, and reporting. Examples include periodic calibrations, routine service checks, instrument specific monthly quality control maintenance checks, and duplicate analyses on split and spiked samples.

Quality assessment is a set of external tasks to provide certainty that the quality control system is satisfactory. These external tasks are performed outside of normal routine operations. For example, independent performance audits, on-site system audits, interlaboratory comparisons, and periodic evaluations of internal quality control data are such tasks.

1.0.4.2 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR CRITERIA POLLUTANTS - The following tasks contribute to the attainment of quality assurance and provide accurate and precise ambient air quality data.

1. Methods, analyzers, or samplers are federal or State reference or equivalent methods. To assist in the specific selection, ARB maintains an on-going program of instrument and method evaluation.

2. Purchase specifications are written for each type of equipment to ensure that only equipment of the desired quality is obtained.

3. Prior to payment, the ARB performs acceptance tests on new equipment. The acceptance tests consist of testing the equipment to ensure that it meets the requirements listed in the purchase specifications.

   For analyzers, the acceptance test consists of at least checking zero drift, span drift, voltage stability, temperature stability, and linearity. Acceptance test procedures are contained in Volume II for each specific analyzer. Results of these tests are maintained in the central instrument file in Sacramento.

4. Equipment is installed to conform with 40 CFR Part 58, the manufacturer's instruction manual, and guidelines set forth in Volume II, for each specific analyzer.

5. Calibrations are performed in accordance with ARB or U.S. EPA approved calibration procedures.

6. ARB quality control procedures require the use of frequent zero, span, and precision checks. However, caution should be exercised before zero or span adjustments are performed. Often, problems causing analyzer response shifts are due to analyzer malfunctions. Consequently, zero and span adjustment procedures, given in the appropriate appendix in Volume II, are developed to compensate only for normal expected variations in the analyzer response. These procedures are instrument specific; as such, uniform control limits for zero and span adjustments, when applicable, are developed based on instrument stability, gas standards, reliability, and time required to perform the adjustments. Also, the timing of checks should not coincide with times of the day when the pollutant concentrations are at or near peak levels.

7. Analyzers and/or samplers are operated in accordance with the manufacturer's recommended standard operating procedures as presented in the manufacturer's instruction manual and in the specific Volume II appendix. Routine service checks and instrument specific Monthly Quality Control Maintenance Checksheets are used to provide accurate and precise data.

8. Quality control is further enhanced at selected field stations by installing Environics Model 9100, Dasibi Cal II, or Columbia Scientific Industries (CSI) calibrators. The Model 9100 Calibration System consists of three components: (1) the Model 9100 Calibrator; (2) a Pure Air Generator, and (3) bottled gas cylinder blends consisting of high concentrations of NO, CO, SO2, and CH4 in a nitrogen balance. The CSI Calibrator consists of a Model 1795 Calibration Air Supply Chassis and a Model 1790 Programmable Gas Calibration Chassis. The CSI calibrator uses permeation tubes except for zero air and ozone.

   The gas calibration systems conduct through-the-probe (TTP) calibration checks. Calibration checks are performed automatically each day. Special calibration checks may also be remotely initiated through the modem/phone/PC AQDAS system designed especially for the verification of emergency episodes. The daily calibration checks enable analyzer malfunctions to be detected promptly. A detailed description of the CSI calibrator is presented in Volume II, Appendix I. The Dasibi Cal II is presented in Volume II, Appendix G.

9. Quality assessment is accomplished through performance audits and system audits. These audits are an integral part of the ARB Quality Assurance Program. A brief description of various quality assurance tasks follows:

   a. Performance Audits - Performance audits establish individual analyzer accuracy and overall agency accuracy. The audit is performed through-the-probe/manifold to measure the integrity of the monitoring system. Performance audits are performed on at least 25 percent of the analyzers within the ARB reporting organization every 3 months, such that each analyzer is audited a minimum of once a year. Refer to Volume V, Audit Procedures, for details.

   b. System Audits - System audits are on-site inspections and reviews of the entire quality assurance program. It is a qualitative appraisal of the organization, the written procedures, and the records and documentation required to carry on a successful data collection activity. This audit also includes review of the siting requirements and their compliance with 40 CFR Part 58.

   c. Corrective Action - When an analyzer/sampler response differs from true by more than $\pm$10 percent ($\pm$7 percent for PM10 and $\pm$4 percent for PM2.5), maintenance and/or recalibration is required. In general, air quality data are not corrected if the data are within $\pm$15 percent ($\pm$10 percent for PM10 and $\pm$4 percent for PM2.5) of the true value.

      Whenever an audit indicates collected data deviate by more than $\pm$15 percent ($\pm$10 percent for PM10 and $\pm$4 percent for PM2.5) from true, or the converter on a NOX analyzer is operating below 96.0 percent, or if siting criteria or temperature control is not met, the auditor initiates an Air Quality Data Action (AQDA) request. An AQDA request withholds data from ARB's data bank pending investigation and necessary corrective action. Pursuant to an AQDA request, after resolution of any questionable data, the data are either corrected or deleted from the data bank. Detailed data validation procedures are discussed in Section 1.0.6 of this volume.

d. Reaudits - Reaudits are also performed as soon as possible to verify that the deficiencies discovered during a previous audit have been corrected.

e. Collocated Sampling - Collocated sampling consists of two identical samplers running at the same location, monitoring approximately the same air mass (i.e., PM10 samplers). Collocated ambient air monitoring data provide information on the ability of the samplers to generate equivalent data.

f. Parallel Sampling - Parallel sampling consists of either two different types of samplers run by the same agency, or two identical samplers running side-by-side operated by different agencies. Parallel ambient air monitoring data are used to identify sample handling or matrix effects.

g. Laboratory Audits - Laboratory audits of PM10 samples for mass are performed by reweighing 10 percent of samples on a continuous basis. A private contractor recertifies analytical balances yearly. Glass fiber filter strips are received from the U.S. EPA quarterly for lead and semi-annually for nitrate and sulfate as part of the National Performance Audit Program (NPAP) for laboratory analysis. Laboratory performance audits also include conducting standard weight checks using a set of class S standard weights, relative humidity and temperature sensor checks, and a review maintenance logs and quality control records.

h. Quality Control and Quality Assurance Documentation - Monthly Quality Control Maintenance Checksheets and calibration reports are reviewed by appropriate air quality managers or their designees. Acceptance test reports, Monthly Quality Control Maintenance Checksheets, and calibration reports are filed with the Air Quality Surveillance Branch. Single continuous analyzer and single high-volume sampler audit/accuracy report forms are used to document performance audits. These forms and preliminary audit reports are filed in the Quality Assurance Section files. System audit data are recorded on U.S. EPA approved questionnaires and filed in the QAS files.

1.0.4.3 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR TOXICS

1. The ARB maintains an on-going program of sampler and method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Toxics samplers are installed to conform with the manufacturer's manual and guidelines and cleanliness criteria set forth in the Volume II appendices for the specific samplers.

3. Calibration of toxic samplers regarding flow rates are performed in accordance with ARB approved procedures as contained in Volume II.

4. Samplers are operated in accordance with the manufacturer's recommended standard operating procedures as presented in their instruction manuals and in the specific Volume II appendices. Routine leak checks are performed on samplers and station probes to assure representative data.

5. Quality assessment of toxics data quality is accomplished through performance audits, which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Through-the-Probe (TTP) Toxics Audits - Toxics TTP audits are conducted annually at each site by the QAS. A sample (canister) is filled with known (assigned) concentrations of audit gases approximating ambient toxics levels during a 24-hour period. The operator handles and transports the audit sample in the same manner as if it were a routine ambient sample. The analytical laboratory analyzes the sample as a "blind sample" since it is not notified of the audit beforehand. QA then requests the analytical results and calculates the percent difference of the sample for various volatile organic compounds (VOC's), and issues a report.

$$\text{Percent Difference} = \frac{(\text{Measured Conc.}^* - \text{Assigned Conc.})}{\text{Assigned Concentration}} \times 100$$

*Conc. = Concentration

The purpose of a TTP toxics audit is to assess the accuracy of the total measurement system, including errors inherent in contamination due to dirty containers and transport, effects of sample pump and probe, and laboratory error. The detailed toxic audit procedure is contained in Volume V, Appendix J.

b. Toxics Laboratory Performance Audits - The performance of various participating analytical laboratories is monitored semiannually; the list includes ARB's Southern Laboratory Branch (SLB), Northern Laboratory Branch (NLB), Bay Area Air Quality Management District, South Coast Air Quality Management District, and the San Diego County Air Pollution Control District. These laboratories are sent low concentration National Institute of Standards and Technology (NIST) cylinders containing VOC's normally found in ambient air. Their analytical results are compared with the known cylinder (assigned) values and percent difference are calculated as in Volume V, Appendix M. A semiannual report is issued to each laboratory notifying them of the results of the performance audit. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix M.

c. Ambient Air Comparison-Multiple ambient air samples are simultaneously collected into stainless steel canisters annually by the QA staff at a site historically known for high concentrations of VOCs. These canisters are sent to various analytical laboratories for analysis. The results are statistically compared and used to identify areas that need further improvement.

1.0.4.4 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR METEOROLOGICAL PARAMETERS - The following tasks contribute to the attainment of quality assurance and provide accurate and precise ambient air quality data.

1. The ARB maintains an on-going program of sampler and method analyses evaluation, concise written specification and acceptance testing to ensure that

only equipment of the desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Meteorological equipment is installed, operated, and maintained in accordance with the manufacturer's manual, and the guidelines set forth in U.S. EPA Prevention of Significant Deterioration (PSD) and Volume IV (Quality Assurance Handbook for Meteorological Parameters) publications, and ARB Volume II.

3. The equipment is calibrated according to the manufacturer's manual and ARB approved procedures in Volume II.

4. Routine field checks are performed to assure representative data.

5. Assessment of meteorological data quality is accomplished through performance audits, which are an integral part of the ARB quality assurance program. Detailed audit procedures are presented in ARB Volume V, Appendix S. A brief description of these audit procedures follows:

    a. Percent Relative Humidity - A triplicate collocated comparison is performed, using a capacitance method humidity sensor. The station sensor and audit sensor measurements are converted to dew point temperature prior to calculating the audit results.

    b. Wind Speed - The sensor's conversion of the sensor shaft's rate of rotation to wind speed is challenged by attaching a variable speed synchronous motor. The starting threshold speed of the sensor is measured using a torque disk, which verifies bearing function.

    c. Wind Direction - Proper sensor orientation is verified using a pocket transit. The sensor accuracy is verified by orientation into the cardinal directions, known landmarks, or by attaching a degree fixture onto the sensor.

    d. Ambient Temperature - When the sensor can be immersed in water, a comparison of temperatures of three water baths is made. A digital thermistor thermometer is also immersed in the water baths. The measurement of the station sensor and the audit sensor are compared.

If the sensor is not water immersible, a triplicate collocated comparison will be performed using the digital thermistor thermometer.

NOTE: Meteorological Equipment Traceability is discussed in Section 1.0.5.1.

1.0.4.5 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT OF NON-METHANE HYDROCARBONS IN AMBIENT AIR

1. The ARB maintains an on-going program of method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Non-methane hydrocarbon (NMHC) gas chromatographs (GCs) and samplers are installed and operated to conform with the manufacturer's manual and guidelines.

3. GCs and samplers are operated in accordance with the ARB's and manufacturer's recommended standard operating procedures as presented in their instruction manuals.

4. Calibration of NMHC GCs and sampler flow rates are performed in accordance with ARB approved procedures found in Volume II. Routine leak checks are performed on samplers and station probes to assure representative data. Quality control checks, blanks, and duplicates are used to assure the accuracy and precision of the GCs.

5. Quality assessment of NMHC data is accomplished through performance audits which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Laboratory Performance Audits - The performance of the participating analytical laboratories is monitored annually. The list includes: ARB's Northern Laboratory Branch, Bay Area Air Quality Management District, San Diego County Air Pollution District, Ventura County Air Pollution Control District, South Coast Air Quality Management District, and various private contractors. The laboratories are sent low

concentration National Institute of Standards and Technology (NIST) cylinders containing NMHCs normally found in ambient air. Their analytical results are compared with the known cylinder (assigned) values and percent biases are calculated as in Volume V, Appendix N. A report is issued to each laboratory notifying them of the performance audit results. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix N.

b. Through-the-Probe (TTP) Performance Audits - NMHC TTP audits are conducted annually at each site by QA staff. A sample canister is filled with known (assigned) concentrations of audit gases approximating ambient NMHC levels normally collected during a three-hour period. The operator handles and transports the audit sample in the same manner as if it were a routine ambient sample. The analytical laboratory analyzes the sample as a "blind sample", since it is not notified of the audit beforehand. QA then requests the analytical results and calculates the percent bias of the sample for various NMHCs and issues a report.

$$\text{Percent bias} = \frac{(\text{Measured Conc.}^* - \text{Assigned Conc.})}{\text{Assigned Conc.}} \times 100$$

The purpose of a TTP NMHC audit is to assess the accuracy of the total measurement system, including errors inherent by contamination due to dirty containers and transport, effects of sample pump and probe, and laboratory error. The detailed NMHC through-the-probe audit procedure is contained in Volume V, Appendix W.

c. U.S. EPA National Performance Audit Program (NPAP) audits - The NMHC laboratories also receive blind samples prepared by the U.S. EPA as part of a national audit program which measures the accuracy of various hydrocarbon compounds. The audits are conducted during the Photochemical Assessment Monitoring Station (PAMS) season.

*Conc. = Concentration

d. Ambient Air Comparison Checks - Multiple ambient air samples are simultaneously collected into stainless steel canisters annually by the QA staff at a site historically known for high concentrations of NMHCs. These canisters are sent to various analytical laboratories for analysis. The results are statistically compared and used to identify areas that need further improvement.

e. Corrective Action and Reaudits - Whenever an audit indicates that an instrument's response has deviated beyond acceptable limits, the station operator is notified of the problem and that corrective action should be taken. Reaudits are performed to verify that the deficiencies have been corrected.

1.0.4.6 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR LABORATORY ANALYSIS OF NON-METHANE HYDROCARBONS IN MOTOR VEHICLE EXHAUST

1. The ARB maintains an on-going program of method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. NMHC GCs are installed to conform with the manufacturer's manual and guidelines.

3. GCs are operated in accordance with the ARB's and manufacturer's recommended standard operating procedures as presented in their instruction manuals.

4. Calibration of NMHC GCs are performed in accordance with ARB approved procedures. Quality control checks, blanks, and duplicates are used to assure the accuracy and precision of the GCs.

5. Quality assessment of NMHC data is accomplished through performance audits which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Non-methane Hydrocarbon Laboratory Performance Audits - The performance of the ARB's Southern Laboratory Branch is monitored

annually. This laboratory is sent high concentration NIST cylinders containing non-methane hydrocarbons normally found in motor vehicle exhaust. Their analytical results are compared with the known cylinder (assigned) values and percent biases are calculated as in Volume V, Appendix X. A report is issued to the laboratory notifying them of the performance audit results. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix X.

1.0.4.7 QUALITY REPORTS TO MANAGEMENT - In order to apprise management on the performance of quality assurance tasks, the following reports are issued.

1. Criteria Pollutant Including Through-the-Probe Performance Audits Reports
2. System Audit Reports
3. Toxics Laboratory Performance Audit Reports
4. Report of Through-the-Probe Toxic Audit Results
5. PM10 Laboratory Performance Audit Reports
6. Meteorological Audit Reports
7. District PM10 Mass Weighing Audit Reports
8. Acid Deposition Field and Laboratory Audit Reports
9. Annual Hydrological Reports
10. TEOM/BAM Field Performance Audit Reports
11. NMHC Laboratory Performance Audit Results
12. NMHC Through-the-probe Performance Audit Results
13. Motor Vehicle Exhaust Laboratory Performance Audit Results
14. Status Report of Air Quality Data Actions (AQDA's)

1.0.5 POLLUTANT STANDARDS

1.0.5.1 TRACEABILITY - Gaseous standards (permeation tubes, compressed gases, etc.) used to obtain test concentrations for CO, CH4, H2S, SO2, and NO2 are certified by comparison to a NIST gaseous Standard Reference Material (SRM). Test concentrations for ozone are referenced to an in-house NIST standard reference photometer. Test concentrations of VOC gases for the toxic audit program, NMHC audit program, and motor vehicle audit program are obtained from NIST gas cylinders.

Flow measurements are referenced to a primary NIST traceable volume or flow device.

Acid deposition audit samples are made by QA staff using samples from the latest U.S. EPA performance survey and tested against in-house NIST standards.

Meteorology Equipment Traceability: The rotation per minute of the motors is traceable by an internal integral optical encoder which provides direct read-out on the drive unit display. Pulse output from the optical encoder can be measured by a calibrated external frequency counter or data logger. The weights used on the torque disks are verified in calibrated scales. The thermistor temperature system is traceable to ASTM certified thermometers. The percent relative humidity capacitance sensor is traceable to humidity salt solutions standards. The psychrometer thermometers are traceable to ASTM certified thermometers. Torque watches are traceable by factory calibration. The rest of the met audit equipment do not have any traceability specifications.

1.0.5.2 RESPONSIBILITY - Within the ARB reporting organization, the PE&S Section provides certification of transfer or field standards.

1.0.5.3 HIERARCHY - The ARB maintains a hierarchy of standards depending on their intended use. Table 1.0.5.1 summarizes hierarchy and usage of gaseous pollutants, ozone, and flow standards. Acid rain samples are bought from NIST. The dry acid deposition also uses the stated flow standards.

1.0.5.4 CERTIFICATION CRITERIA - Each standard shall meet ARB certification criteria. These criteria are based on several factors, including long term stability, reliability, use, and practicality of recertification.

For compressed gases, the three most recent assays must have a relative standard deviation [(standard deviation / mean) x 100 percent] of less than 1 percent for ambient concentration cylinders and less than 1.5 percent for high concentration cylinders that must be diluted (applies to criteria pollutants).

For flow transfer standards, the relative standard deviation for the slope must be less than 1 percent and the intercept divided by full scale reading x 100 percent must be less than 1 percent for the last four calibrations.

For ozone transfer standards, the standard deviation for the slope must be less than 0.015 and the intercept standard deviation must be less than 0.005 for the last six calibrations.

TABLE 1.0.5.1
TYPES AND HIERARCHY OF CRITERIA/TOXIC POLLUTANT STANDARDS

TYPE:	**COMPRESSED GAS**	**OZONE**	**FLOW**
HIERARCHY:			
PRIMARY	**NIST - SRM**	**NIST REFERENCE PHOTOMETER**	**BROOKS METER / ROOTS METER**
USE:	CERTIFICATION OF LABORATORY STANDARDS	CERTIFICATION OF OZONE TRANSFER STANDARDS	CERTIFICATION OF ORIFICES, MASS FLOW METERS AND CONTROLLERS
SECONDARY	**LABORATORY STANDARD**	**TRANSFER STANDARD**	**ORIFICE MASS FLOW METER AND CONTROLLER**
USE:	CERTIFICATION OF WORKING STANDARDS	INSTRUMENT CALIBRATION, INSTRUMENT AUDITS	INSTRUMENT CALIBRATION, INSTRUMENT AUDITS, COMPRESSED GAS ASSAY
TERTIARY	**WORKING STANDARD**	**NONE**	**ROTAMETER**
USE:	INSTRUMENT CALIBRATION, INSTRUMENT AUDITS, INSTRUMENT PRECISION		FLOW CHARTS FLOW INDICATION

NOTE: The primary gas standard for SO2 is an NIST-SRM permeation device. All other SO2 standards are compressed gas standards. H2S is converted to SO2 and is traceable through an SO2 NIST-SRM permeation device. All compressed gases and rain sample standards (acid deposition) come from NIST and U.S. EPA.

1.0.6 DATA PROCESSING AND VALIDATION

Sections 1.0.6.1 through 1.0.6.3 apply to Criteria Pollutants

1.0.6.1 DATA PROCESSING - The ARB's air monitoring program collects real-time pollutant values and samples of ambient air throughout California. The program also is designed to ensure the quality of the data collected and disseminated by the ARB and California's air quality districts. The data generated are used to determine which areas of California are in attainment, or non-attainment, and the severity of pollution in California. The data are also used in air models and emission inventory.

The Air Quality Data Acquisition System Version II (AQDASII) is used to collect, process, and report air quality data for the Air Resources Board's Statewide air monitoring network. Dataloggers located in the monitoring stations convert the analog output of the various analyzers (ozone analyzers, carbon monoxide analyzers, etc.) into digital minute and hour averages. These averages are polled over telephone lines via an AQDASII Communication Server and stored in a SQL database on an AQDASII file server. The data is then accessed and edited by workstations on the Local Area Network (LAN). The LAN, database, workstations, and servers comprise the AQDASII.

Within the ARB, the staff of the Monitoring and Laboratory Divisions, Air Quality Surveillance Branch (AQSB) performs three levels data review of the ambient data. The first level review is done by the station operator who verifies the data and evaluates the accuracy of the data through evaluation of the daily calibration checks. The second level review consists of spot checks of the ambient data and a review of the required equipment maintenance. The third level review consists of reconciliation of data from hard copy to electronic copy, confirming second level edits exported correctly within the electronic version; scan reports and historical highs and lows are verified, and spikes and anomalies are verified.

Under agreements with data suppliers, some monitoring agencies will submit air quality data directly to the U.S. EPA's Aerometric information Retrieval System (AIRS) database via modem and telephone link. These monitoring agencies will process their data submittals through computers routines on AIRS that provide an electric review of the data. AQDR section will then transfer a copy of the data to the ARB data management system, ADAM.

Other monitoring agencies will continue to submit air quality data directly to AQDR section. The AQDR section will log the data and check for gross errors within the screening files to be processed using data review routines.

Site reports are generated or amended for State and local air monitoring stations, national air monitoring stations, and special purpose monitoring stations by the field technicians. A copy of the report stays with the agency that operates the station, and a copy is sent to the AQS Branch of the Monitoring and Laboratory Division (MLD). A complete site report must be on file in MLD's Air Quality Monitoring - North section. A site number is assigned by the reporting agency prior to reporting data for record to ARB and/or U.S. EPA. Site numbers are assigned when a complete site report is received. The MLD keeps the original site report on file.

1.0.6.2 DATA VALIDATION - After the monthly submittals of criteria pollutant ambient air quality data have been checked for gross errors by levels one, two and/or three of the reporting agency, the electronic data are stored in the database. The edits are also screened for a minimum and maximum level for each pollutant. These edits are intended to catch obvious errors and outliers in the data. Errors identified by the editor are questioned and resolved. Once the data are in the database, printouts of the data are run by the AQDR Section and reviewed for questionable or missing data. The AQDR Section confers with the responsible data supplier regarding suspected errors. If errors are found, questionable or missing data questions are forwarded to the proper reporting agency. That agency would then validate the data and return comments to the AQDR Section. The AQDR Section runs several reports, which determine the completeness and representativeness of the data.

1.0.6.3 AIR QUALITY DATA ACTION - An Air Quality Data Action (AQDA) is a request for an investigation of the validity of ambient air quality data for a certain period of time. Figure 1.0.6.3 depicts an AQDA request form. AQDA requests can be initiated by any person suspecting erroneous data and serves as a means for withholding questionable air quality data pending further investigation.

AQDAs are generally issued by the QA Section staff based upon review of field calibrations or audit results which show an analyzer/sampler operating outside ARB's control limits of ±15 percent (±10 percent for (PM10) or for siting or temperature conditions within the station not meeting specifications. The original AQDA is sent to the person responsible for submitting the respective data to the appropriate Air

Monitoring (AM) Section or Air Pollution Control District (APCD). A copy of the AQDA is sent to the AQDR Section, which withholds the air quality data from processing and publication until the data are determined to be within limits.

After receiving the AQDA request, the appropriate air monitoring staff, within 30 days, investigates the questionable data and generally responds to QA with a recommended data action and its justification, which QA staff then reviews. If QA is in agreement with the response, the AQDA is completed, signed, dated, and forwarded to the AQDR Section for appropriate action, i.e., data correction, acceptance, or deletion for the affected time period.

If QA is not in agreement with the response, follow-up recommendations and their justifications are exchanged with the appropriate staff to work towards a satisfactory resolution. QA then informs the AQDR Section regarding final data action and disposition of the AQDA. The AQDR Section then completes the recommended data action.

The QA Section may request that the AQDR Section delete the questionable data in the absence of response from AM/APCD within 30 days or if the data are greater than ±25 percent from true levels, as determined by zero, span, and precision checks. QA may recommend data be invalidated or corrected back to the initial occurrence of the malfunction. If the malfunction date cannot be verified, the data can be invalidated or corrected back to the last successful calibration or audit.

1.0.6.4 CHANGES TO PROCESSING AND VALIDATION PROCEDURES

Figure 1.0.6.2 depicts the general process a district or the ARB will use to process data into the AIRS and ARB databases. The handling of site reports by the ARB may also change, although new procedures have not yet been determined.

Questions regarding the above procedures can be addressed to the AQDR Section (916-324-7672) or the QA Section (916-324-6191) of the ARB in Sacramento.

1.0.6.5 AMBIENT TOXICS DATA REVIEW

The ARB Monitoring and Laboratory Division's (MLD) Northern Laboratory Branch submits ambient toxics data to the Planning and Technical Support Division (PTSD) for verification and storage. MLD provides six toxics submittal formats to PTSD for each calendar month. The six submittals group the toxics species as follows:

1. Gases	Unoxygenated volatile organic compounds
2. Aldehydes	Oxygenated volatile organic compounds
3. PAHs	Polycyclic aromatic hydrocarbons
4. LoVol Metals	Metals collected with a low-volume sampler
5. Cr+6	Hexavalent Chromium

Distinct sampling methods define the groupings. For example, gas samples are collected in stainless steel canisters, whereas aldehyde samples are collected with adsorbent tubes, PAHs with SSI equipped HiVol samplers, etc.

MLD screens these submittals electronically for proper coding, expected sites, expected compounds, data representativeness, and data completeness. In addition, PTSD compares each individual measurement statistically to a data record that is specific to each compound and site. Measurements that deviate significantly from the expected (usually with less than a one percent likelihood of occurrence) are flagged for further evaluation.

PTSD refers flagged measurements, possible data errors, and other questionable matters to MLD in an informal Data Inquiry. MLD investigates the questions raised and recommends appropriate action in its response to the Data Inquiry. When the questions have been resolved to PTSD's and MLD's mutual satisfaction, the data are read into a ADAM database where the data are available for general use.

The Northern Laboratory Branch (NLB) of the ARB performs quality control reviews of ambient toxic data. Periodic checks of charts for monthly averages and trends are done. Normal QC procedures include checking duplicates, QC charts, blanks, spikes, standards, and review of chromatographs. The lab checks in-depth on all unusual events. They scan the data reports to look for results that appear unusually high or low.

1.0.6.6 TEOM AND BAM DATA REVIEW

Quality Assurance audit procedures for these samplers are contained in the QA Manual, Volume V, Appendix V. AQSB is submitting data to AIRS and is currently performing quality control flow checks and comparisons of the data against SSI/dichots for outliers.

1.0.6.7 NON-METHANE HYDROCARBONS IN AMBIENT AIR DATA REVIEW

The data validation guidance for non-methane hydrocarbons in ambient air encompasses mainly routine checks, tests for internal consistency, and historical data comparisons. Additional checks for parallel consistency, which incorporate statistical evaluations, may be considered for data validation. A flow chart of data validation activities is shown in Figure 1.0.6.4.

1.0.6.8 NON-METHANE HYDROCARBONS IN MOTOR VEHICLE EXHAUST DATA REVIEW

The data validation guidance for non-methane hydrocarbons in motor vehicle exhaust encompasses mainly routine checks, tests for internal consistency, and historical data comparisons. Additional checks for parallel consistency, which incorporate statistical evaluations, may be considered for data validation. A flow chart of data validation activities is shown in Figure 1.0.6.4.

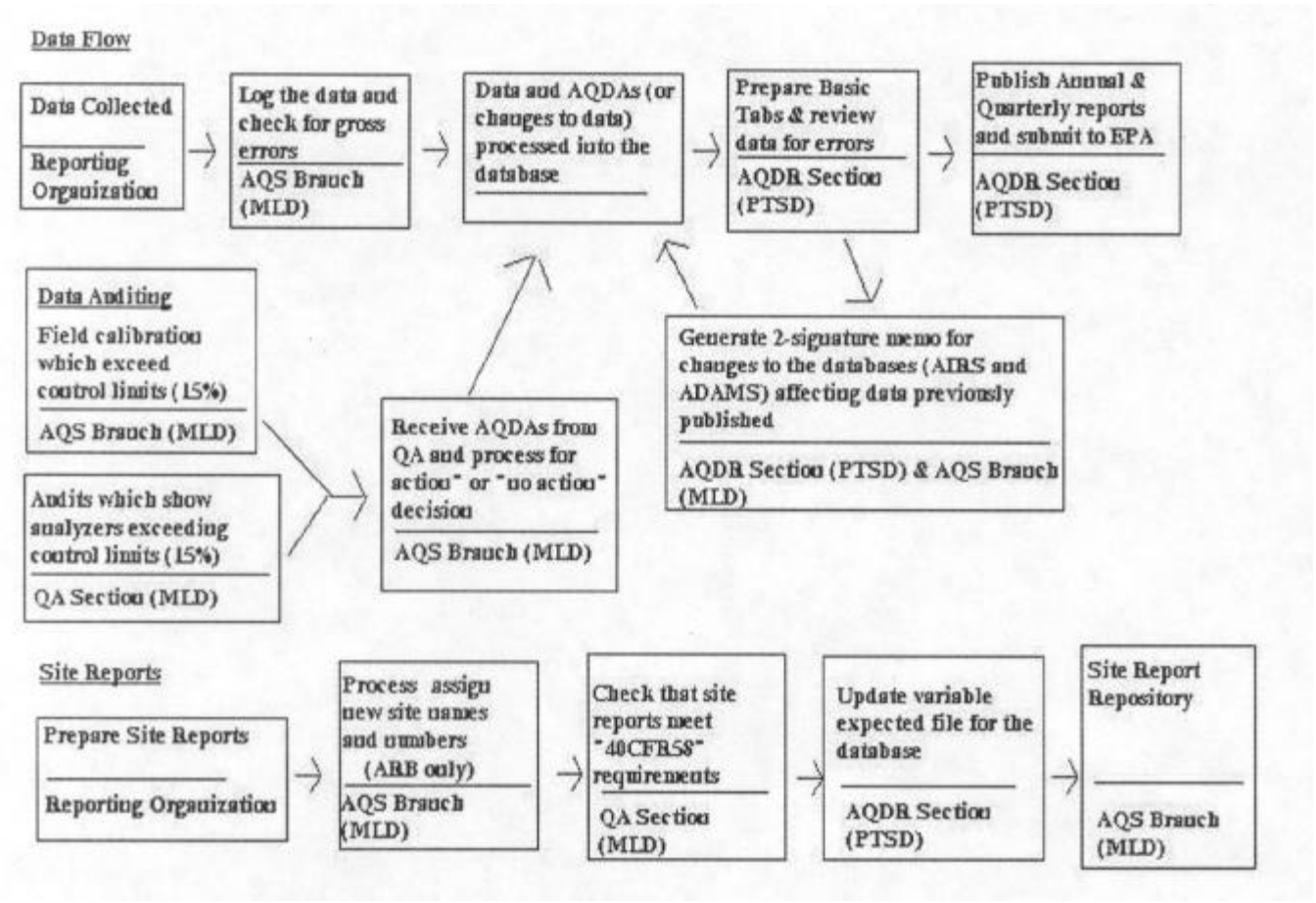


Figure 1.0.6.1
Data Processing and Validation-Criteria Pollutants

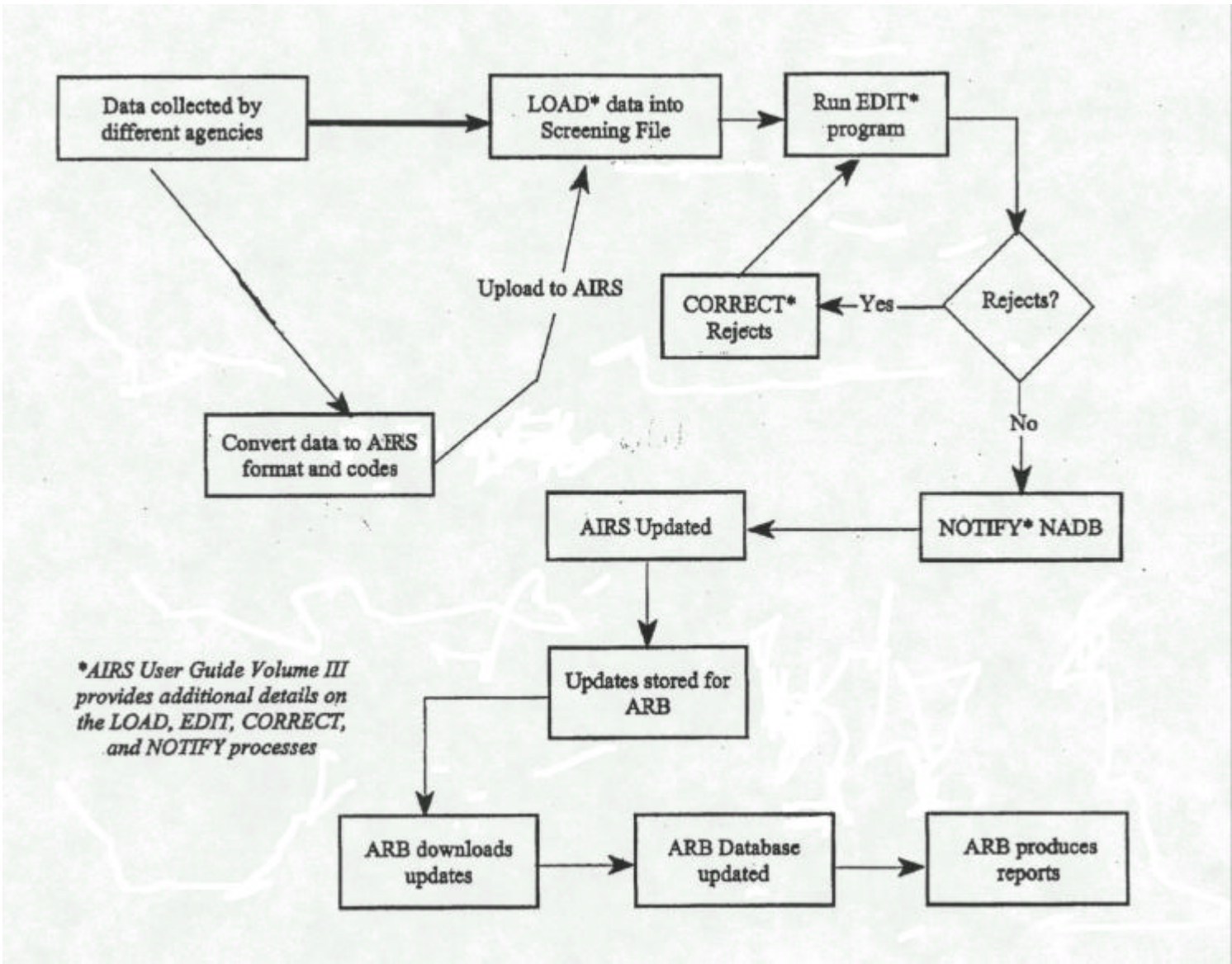


Figure 1.0.6.2
General Process to Load Data into AIRS/ARB Database

AIR QUALITY DATA ACTION REQUEST

(For ARB Use Only)

SITE NAME:	Clovis – North Villa	REQUEST LOG #:	844
SITE NUMBER:	10248 AIRS#: 060195001	REQUEST DATE:	August 3, 1998

TO: George Jung , Air Monitoring/APCD. Please investigate the potential inaccuracies listed below * and recommend appropriate action/s. If no response to this action is received by September 3, 1998 QA staff shall review and recommend appropriate action/s.

TO: Norma Montez , Air Quality Data Review. Please withhold the following air quality data from processing until potential data inaccuracies are resolved.

FROM: John Kato , Quality Assurance Section.

* Potential Data Inaccuracies

POLLUTANT	EST. TIME PERIOD *			REASON FOR ACTION
NMHC	FROM:			Audit conducted on July 30, 1998, found the analyzer to be an average of 19.2% from true.
	12	16	96	
CODE	Month	Day	Year	
	TO:			
	9	30	98	
	Month	Day	Year	

Air Monitoring/APCD to complete the following block from their quality control records, sign, and return to Quality Assurance Section. * Exact interval to be determined by district.

RECOMMENDED DATA ACTION		TIME PERIOD (INCLUSIVE)					CORRECTION FACTOR
RELEASE:		BEGIN:					
DELETE:		END:					
CORRECT:			Hour	Month	Day	Year	

JUSTIFICATION

REVIEWED BY:

1. _____ DATE: _____
2. _____ DATE: _____
3. _____ DATE: _____
4. _____ DATE: _____

The recommended data actions were applied and the air quality data were updated on the AIRS/ADAM Database by _____ on _____.

MLD-40/12/92

Figure 1.0.6.3
Air Quality Data Action Request

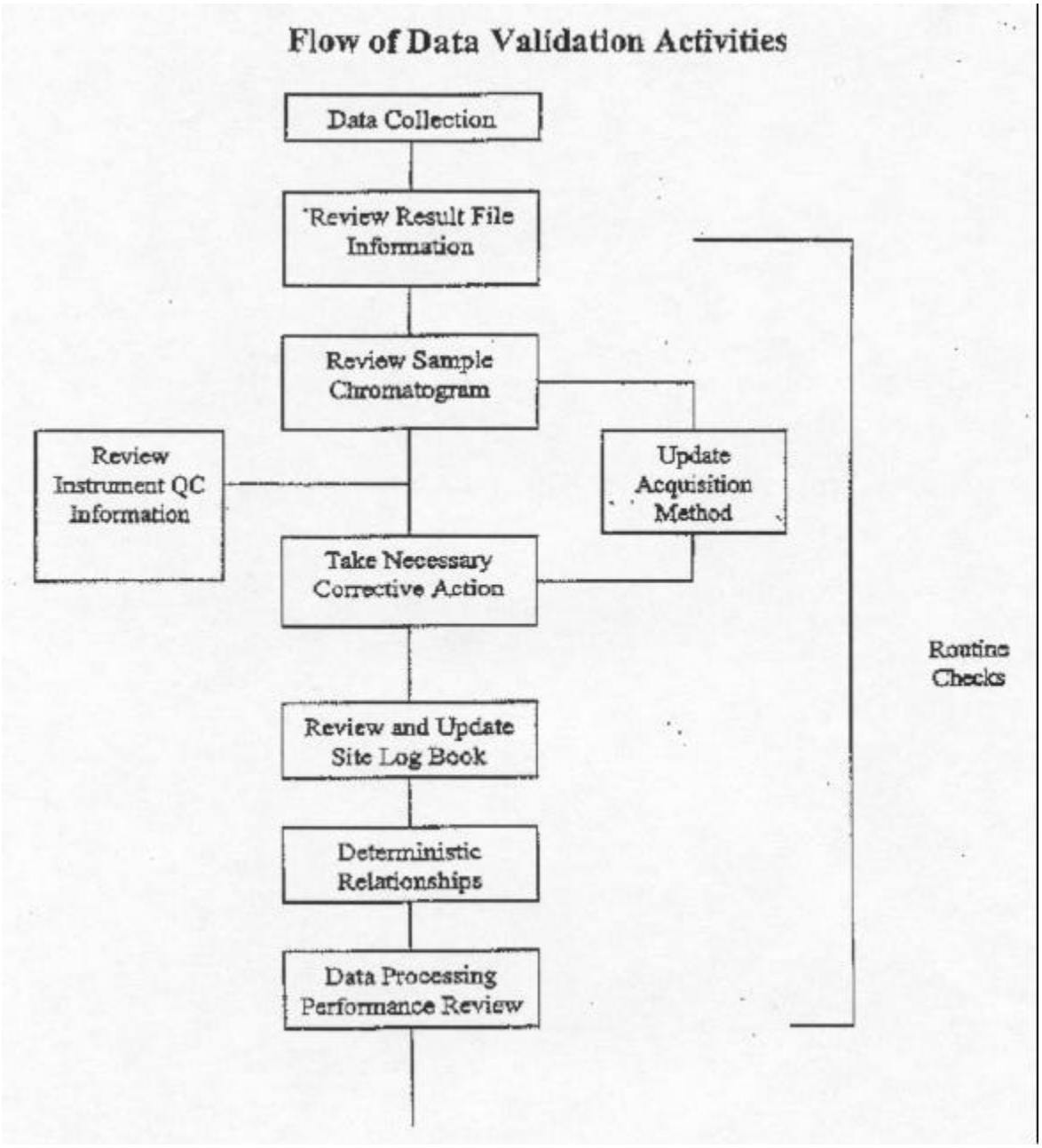


Figure 1.0.6.4
Non-Methane Hydrocarbons Data Validation Activities

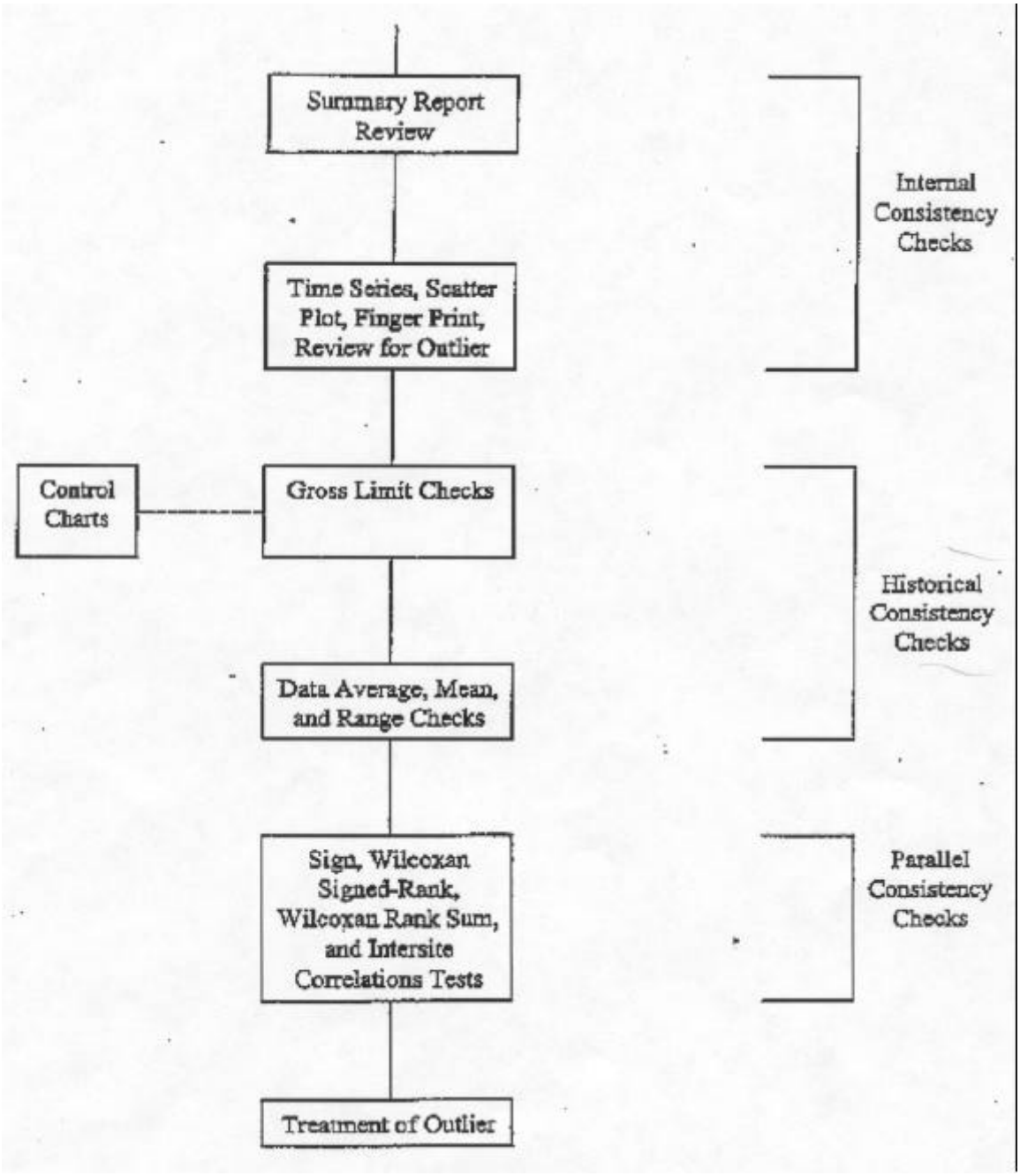


Figure 1.0.6.4 (cont.)
Non-Methane Hydrocarbons Data Validation Activities

1.0.7 DATA ASSESSMENT PROCEDURES
Sections 1.0.7.1 Through 1.0.7.6 Apply to Criteria Pollutants

1.0.7.1 RESPONSIBILITY - Within the ARB reporting organization, the Quality Assurance Section (QAS) schedules and conducts performance audits and calculates and reports air quality data accuracy. The Environmental Protection Agency's (U.S. EPA) 40 CFR Part 58 contains criteria and requirements for ambient air quality monitoring and for reporting ambient air quality data and information.

The QAS staff also develops procedures and compiles precision data. Operating agency monitoring personnel perform the precision tests and report the data to the QAS within 60 days after the end of the calendar quarter. Some precision data reported by monitoring personnel, such as from Dasibi Cal II sites, are already in reduced format by site. QAS staff incorporate all precision data and reports it quarterly to the U.S. EPA.

1.0.7.2 SCOPE - QAS staff estimates the air quality data accuracy for each gaseous criteria pollutant using results from analyzer performance audits. Staff conducts performance audits by challenging an analyzer with a gas of known concentration at each level falling within the analyzer's measurement range. TSP and PM10 are audited by a measurement of flow rate and accuracy determined from the deviation from true value. The prescribed U.S. EPA audit levels are:

	Concentration Range, PPM		Flow Rate Range, CFM		
Audit Level	NO2, SO2, O3, H2S	CO	TSP	PM10	PM2.5
1	0.03-0.08	3-8	39.0-60.0	36.0-44.0	15.84-17.5
2	0.15-0.20	15-20			
3	0.35-0.45	35-45			
4*	0.80-0.90	80-90			

*Audit level 4 is generally not required at ARB sites due to analyzer range limitations or low ambient concentrations encountered. A waiver has been received from U.S. EPA indicating ARB does not need to run this level for stations that do not report ambient levels at this range.

Air Monitoring staff obtains air quality precision data for each gaseous criteria pollutant using results from single point precision tests performed at least five times each week on each automated analyzer. Monitoring personnel perform the precision tests by challenging the analyzer with a precision test gas of known concentration between 0.08 and .10 ppm for SO2, NO2, and O3 analyzers and between 8.0 and 10.0 ppm for CO analyzers.

Staff estimates air quality data precision for TSP, PM10, and PM2.5 measurements using results from collocated samplers operated at selected sites. At least three sites are selected based on the highest expected geometric mean concentration. Additional sites may also be selected. The collocated samplers are operated whenever routine sampling is scheduled (i.e., every six days).

1.0.7.3 AIR QUALITY DATA ACCURACY ASSESSMENT REPORT - QAS staff prepares data accuracy assessment reports. A general description of each report follows. Example formats are shown in Figures 1.0.7.1 and 1.0.7.2.

1. ARB Preliminary Audit Report (Figure 1.0.7.1) - After a performance audit, staff prepares the preliminary audit report. The report provides rapid feedback on analyzer status and can serve as a corrective action flag to the operating agency. A copy of this report is given to the station operator at the completion of each through-the-probe audit.

2. ARB Final Audit Report (Figure 1.0.7.2) - Each year following the fourth quarter, staff estimates and reports data accuracy. The report presents the pooled average data accuracy by pollutant, audit concentration level, and by site. A copy of this report is sent to the Chief of the MLD.

3. U.S. EPA Data Accuracy Assessment Report - As required by 40 CFR Part 58, staff prepares the quarterly and annual EPA Data Accuracy Assessment Report in the form of magnetic disk that is sent to the U.S. EPA Region IX QA Coordinator within 100 days after the end of each calendar quarter.

4. Toxics Through-the-Probe Audit Report (Figure 1.0.7.3) - After a field audit

and laboratory analysis of the canister compounds, staff issues a report comparing the lab measured value with the true value of each compound. This report is sent to the Chief of the Northern Laboratory Branch and the appropriate air monitoring section manager.

1.0.7.4 DEFINITION OF STATISTICAL PARAMETERS FOR ACCURACY

1. Quarterly/Annual Accuracy Report - By site (Figure 1.0.7.2, pp. 23-24).

Average Percent Difference (d_j) - An individual analyzer's data accuracy estimate, determined by averaging all the individual percent differences (d_i) for all audit test levels, for a single analyzer.

Mathematically:

$$d_j = 1/n \sum_{i=1}^{n} d_i, \text{ where } d_i = \frac{Y_i - X_i}{X_i} \times 100$$

Y_i = analyzer's net indicated response, ppm, or indicated flow rate (TSP, PM10, Pb audits)

X_i = known concentration of audit test gas, ppm, or known flow rate (TSP, PM10, Pb audits)

n = number of audit test levels

Standard Deviation (S_j) - A measure of the variability of the single analyzer individual percent differences (d_j) for all audit test levels.

Mathematically:

$$Sj = \sqrt{1/(n-1) \sum_{i=1}^{n} d_i^2 - 1/n \left(\sum_{i=1}^{n} d_i\right)^2}$$

NOTE: Computation of S_j is not possible for manual methods that have only one audit test level and a single audit.

95 Percent Probability Limits - A measure of the upper and lower probability limits (UPL & LPL), of which one would expect to find 95 percent of all the single analyzer individual percent differences for all audit test levels, at a single site.

Mathematically for automated analyzers:

$$UPL_j = d_j + 1.96\ S_j$$
$$LPL_j = d_j - 1.96\ S_j$$

Mathematically for manual methods (i.e. PM10, TSP, Pb):

$$UPL = d_j + 1.96\ S_j / \sqrt{2}$$
$$LPL = d_j - 1.96\ S_j / \sqrt{2}$$

Best Fit Linear Regression - An equation that best represents an analyzer's response when a known amount of audit test gas, ppm, or known flow rate (TSP, PM10, Pb audits) is given to the analyzer.

Mathematically:

$$Y = a + bX$$

$$a = 1/n \sum_{i=1}^{n} Y_i - b \sum_{i=1}^{n} X_i$$

$$b = \frac{\sum_{i=1}^{n} X_i Y_i - (1/n) \sum_{i=1}^{n} X_i \sum_{i=1}^{n} Y_i}{\sum_{i=1}^{n} X_i^2 - (1/n) \sum_{i=1}^{n} X_i^2}$$

2. Quarterly/Annual Accuracy Report - By Pollutant (Figure 1.0.7.2, pp. 25)

Average of the Average Percent Difference (D) - A data accuracy estimate, determined by weighted average of all the single analyzer quarterly average percent difference (d_j) for all audit test levels, for a single pollutant.

Mathematically:

$$D = \frac{n_1 d_1 + n_2 d_2 + ... + n_j d_j + ... + n_k d_k}{n_1 + n_2 + ... + ... + n_j + ... + n_k}$$

n = number of audits for each pollutant

Standard Deviation (S_a) - A measure of the weighted variability of all the single analyzer quarterly standard deviations (S_j) summed for k analyzers, for a single pollutant.

Mathematically:

$$S_a = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_j - 1)S_j^2 + (n_k - 1)S_k^2}{n_1 + ...+ n_j + n_k - n_k - k}}$$

95 Percent Probability Limits - A measure of the upper and lower probability limits (UPL & LPL), of which one would expect to find 95 percent of all the single analyzer individual percent differences, at all audit test levels, for a single pollutant.

Mathematically for automated analyzers:

$$UPL_a = D + 1.96\ S_a$$
$$LPL_a = D - 1.96\ S_a$$

Mathematically for manual methods (i.e. PM10, TSP, Pb):

$$UPL_a = D + 1.96\ S_a / \sqrt{2}$$
$$LPL_a = D - 1.96\ S_a / \sqrt{2}$$

3. Quarterly/Annual Accuracy Report - By Audit Test Level (Figure 1.0.7.2, pg. 26).

Average Percent Difference (d_k) - A data accuracy estimate, determined by averaging all the single analyzer quarterly average percent difference at each audit test level, for a single pollutant.

Mathematically:

$$d_k = 1/k \sum_{i=1}^{k} d_i$$

k = number of audits performed at each audit test level

Standard Deviation (S_k) - A measure of the variability of all analyzers monitoring a single pollutant at a single audit test level.

Mathematically:

$$S_k = 1/(k-1) \sum_{i=1}^{k} d_i^2 - 1/k \left(\sum_{i=1}^{k} di \right)^2$$

95 Percent Probability Limits - A measure of the upper and lower probability limits (UPL & LPL), of which one would expect to find 95 percent of all the single analyzer individual percent differences, for a single pollutant.

Mathematically for automated analyzers:

$$UPL_k = d_k + 1.96\ S_k$$
$$LPL_k = d_k - 1.96\ S_k$$

Mathematically for manual methods (i.e. PM10, TSP, Pb):

$$UPL_k = d_k + 1.96\ S_k / \sqrt{2}$$
$$LPL_k = d_k - 1.96\ S_k / \sqrt{2}$$

1.0.7.5 PRECISION DATA COLLECTION

1. Air monitoring personnel perform analyzer precision tests by passing the test gas through filters, scrubbers, conditioners, or other components used during normal ambient sampling and as much of the ambient air inlet system as possible. CO analyzers may be temporarily modified during the precision test to reduce vent or purge flows, or the test atmosphere may enter the analyzer at a point other than the normal sample inlet, provided that the analyzer's response is not likely to be altered. Those CO analyzers equipped with automatic zero and span systems and sample pumps installed between the analyzer sample inlet and the manifold must have the precision test gas injected upstream of the pump and the automatic zero and span systems.

2. The precision tests are conducted prior to any zero and span adjustments.

3. Precision test data are reported to the QAS on standardized data forms.

4. On days the air quality data are deleted, the precision test data are also deleted.

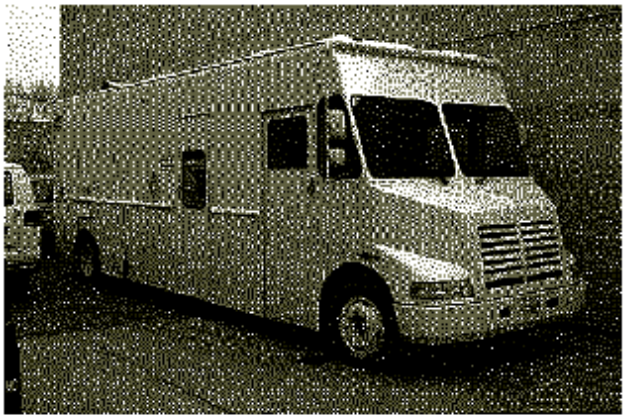
5. Working standards used for generating precision test gases are maintained using the ARB certification criteria.

1.0.7.6 DATA QUALITY PRECISION REPORTING FORM - QAS staff compiles data precision assessment reports submitted by AM/APCD staff.

1. U.S. EPA Data Quality Assessment Reporting Form (Figure 1.0.7.4) - As required by 40 CFR Part 58, staff complies the quarterly reports which contains individual precision tests results for sites within the ARB reporting organization. Within 100 days after the end of each calendar quarter, these reports are submitted to the U.S. EPA Region IX QA Coordinator. Some data are submitted on magnetic disk in accordance with the U.S. EPA recommended AQS format. U.S. EPA calculates the precision estimates for essentially the same parameters defined in Section 1.0.7.4.

California Air Resources Board
Preliminary Performance Audit Report
By
Quality Assurance Section
Monitoring and Laboratory Division

Manager: Michael Miguel **Phone: (916) 324-6191**



Chico-Manzanita Avenue Air Monitoring Station

Audit Date: 11/14/2000

Auditors:
Don Fitzell
Eric Albright

Station Operator:
Bob Land

Report Contents
Executive Summaries
Technical Appendixes
Site Survey Report

Figure 1.0.7.1
Preliminary Audit Report

Executive Summary - Gaseous Criteria

Air Monitoring Station: Chico-Manzanita Avenue Audit Date: 11/14/2000

Parameter	Audit Level	Station Ind. (ppm)	Van Act. (ppm)	Percent Diff.
Ozone	Low	.070	.070	**0.0%**
	Mid	.179	.178	**0.6%**
	High	.403	.400	**0.8%**

Average % Diff.	Standard Dev.	Correlation	Probability Limits Upper 95	Lower 95
0.5%	0.41633	1.00000	1.3	-0.3

Parameter	Audit Level	Station Ind. (ppm)	Van Act. (ppm)	Percent Diff.
Carbon Monoxide	Low	7.49	7.09	**5.6%**
	Mid	19.6	19.0	**3.3%**
	High	37.3	37.1	**0.6%**

Average % Diff.	Standard Dev.	Correlation	Probability Limits Upper 95	Lower 95
3.2%	2.50267	0.99994	8.1	-1.7

Parameter	Audit Level	Station Ind. (ppm)	Van Act. (ppm)	Percent Diff.
Nitrogen Dioxide	Low	.070	.066	**6.1%**
	Mid	.179	.168	**6.5%**
	High	.385	.363	**6.1%**

Average % Diff.	Standard Dev.	Correlation	Probability Limits Upper 95	Lower 95
6.2%	0.23094	1.00000	6.7	5.7

California Air Resources Board
Monitoring and Laboratory Division
Quality Assurance Section

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Executive Summary - Samplers (Flow Rate)

Air Monitoring Station: Chico-Manzanita Avenue Audit Date: 11/14/2000

Parameter	Station Ind.	Van Act.	**Percent Diff.**	**Percent Diff. from Design**
PM10	40.00	40.30	**-0.7%**	**0.8%**
TEOM Main	3.00	3.03	**-1.0%**	**1.0%**
TEOM Aux	13.66	13.50	**1.2%**	**-1.5%**
TEOM Total	16.66	16.40	**1.6%**	**-1.8%**
PM2.5	16.60	17.23	**-3.7%**	**3.4%**
TOTAL METAL	12.00	11.99	**0.1%**	
CR6	11.94	11.99	**-0.4%**	
ALDEHYDYES	0.70	0.66	**6.1%**	

California Air Resources Board
Monitoring and Laboratory Division
Quality Assurance Section

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Executive Summary - Meteorological Sensors

Air Monitoring Station: Chico-Manzanita Avenue Audit Date: 11/14/2000

Audit Parameter & Level	Station Ind.	Van Act.	Diff. or % Diff.
Ambient Temperature (Hot)	47.00	46.80	**0.20**
Ambient Temperature (Warm)	23.20	23.20	**0.00**
Ambient Temperature (Cold)	0.10	0.00	**0.10**
Relative Humidity (Level 1)	73.70	75.20	**-1.50**
Relative Humidity (Level 2)	52.20	49.70	**2.50**
Relative Humidity (Level 3)	24.60	23.50	**1.10**
Wind Direction (East)	88.00	90.00	**-2.00**
Wind Direction (South)	180.0	180.0	**0.00**
Wind Direction (West)	271.0	270.0	**1.00**
Wind Direction (North)	361.0	360.0	**1.00**
Wind Direction (High East)	449.0	450.0	**-1.00**
Horizontal Wind Speed (Level 1)	0.28	0.27	**0.01**
Horizontal Wind Speed (Level 2)	8.28	8.27	**0.12**
Horizontal Wind Speed (Level 3)	16.26	16.26	**0.00**
Horizontal Wind Speed (Level 4)	24.28	24.26	**0.08**
Horizontal Wind Speed (Level 5)	32.25	32.25	**0.00**
Barometric Pressure (Level 1)	758.0	762.0	**-4.00**
Barometric Pressure (Level 2)	758.0	762.0	**-4.00**
Barometric Pressure (Level 3)	758.0	762.0	**-4.00**

California Air Resources Board
Monitoring and Laboratory Division
Quality Assurance Section

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Site Survey Report

Siting Information

Site Name:	Chico-Manzanita Avenue	**Audit Date:**	11/14/2000	**Latitude:**	39 45'27"	**Site Report:**	Y
ARB Number:	04628	**Auditors:**	Don Fitzell	**Longitude:**	121 50'32"	**Site Photos:**	Y
AIRS Number:	060070002		Eric Albright	**Elevation:**	61 meters		
Agency:	California Air Resources Board	**Site Contact:**	Bob Land	**Site Phone:**	(530) 895-5156		

General Siting Conditions

Station Temperature **Controlled:** Y **Recorded:** Y **Inside:** 25 Degrees Celsius	**Traffic** **Description:** Hwy. 99 **Distance:** 500 meters **Count:** 31500	**Dominate Influence** **Category:** Vehicular **Topography** **Site:** Level **Region:** Level	**QA Plan:** Y **Air Flow Arc:** 360 Degrees	**Probe/Man. Clean:** Y **Schedule:** Semi Annually **Autocalibrator Type:** Environics 9100
Meteorology **Collocated:** Y **Shadowing:** N **Boom Orientation:** N/S **Temp. Rad. Shield Asp.:** Motor	**Non-vehicular Local Sources** **Description:** None **Distance:** 0 meters **Direction:**	**Urbanization:** Suburban **Ground Cover:** asphalt	**Site Survey Complete:** Y **Logbook Up to Date:** Y **QA Manual** **Approved:** Y **Agency:** Air Resources Board	

Action Items

- Ground Cover: Aqu=Aquaduct. The site is located next to an aquaduct.

Quality Assurance Section **Page 1 of 3**

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Site Survey Report (Cont'd)

	Instrument Type	Purpose	Objective	Scale	Height Above		Sampler Spacing	Manual Available	Inst. Log Maint'd & Avail.	In Line Filter Change Date	Cal. Gas Cert. Date
					Ground	Platform					
O3	API 400	SLAMS	Representative	Neighborhood	6.6	2.8	N/A	Y	Y	11/13/1900	N/A
SO2											
NO2	TECO 42	SLAMS	Representative	Neighborhood	6.6	2.8	N/A	Y	Y	11/13/1900	04/30/1900
CO	DASIBI 3008	SLAMS	Representative	Neighborhood	6.6	2.8	N/A	Y	Y	11/13/1900	04/30/1900
H2S											
CH4											
THC											
NMHC											
PM10	ANDERSEN 1200	SLAMS	Representative	Neighborhood	5.3	1.6	0.0	Y	Y	N/A	N/A
PM10 Colloc.											
PM2.5	R&P 2000	SLAMS	Representative	Neighborhood	5.8	2.1	0.0	Y	Y	N/A	N/A
PM2.5 Colloc.											
PM2.5 Spec.											
TSP											
TSP Colloc.											
Lead											
Dichot											
TEOM	R&P 1400A	N/A	Representative	Neighborhood	5.2	2.0	0.0	Y	Y	N/A	N/A
BAM											
Temp	MET ONE 060A-2	N/A	N/A	N/A	5.6	2.9	N/A	Y	Y	N/A	N/A
%RH	MET ONE 083D-0-	N/A	N/A	N/A	5.6	2.9	N/A	Y	Y	N/A	N/A
Baro	MET ONE 090D-28	N/A	N/A	N/A	5.6	2.9	N/A	Y	Y	N/A	N/A
WS HORIZ.	MET ONE 010C	N/A	N/A	N/A	10.0	6.3	N/A	Y	Y	N/A	N/A
WS VERTICAL											
WD	MET ONE 010C	N/A	N/A	N/A	10.0	6.3	N/A	Y	Y	N/A	N/A
Solar											
Rain Gauge											
Toxics 920	XONTECH 920	N/A	N/A	N/A	5.0	1.3	N/A	Y	Y	N/A	N/A
Carbonyl 925											
NMOC 910											
Wet/Dry Acid											
AISI Tape											
Nephelometer											

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Site Survey Report (Cont'd)

	Calibration		Cal. Equip. Cert. Date	Description of Obstacle	Dist./Direct. to Obstacle	Height above Inlet	Distance to Walls, etc.	Distance to Dripline	Residence Time
	Current	Cal. Date							
O3	Y	07/05/1900	03/03/1900	None	n/a				18.0
SO2									
NO2	Y	07/05/1900	03/03/1900	None	n/a				19.1
CO	N	11/15/1900	03/03/1900	None	n/a				16.4
H2S									
CH4									
THC									
NMHC									
PM10	Y	09/05/1900	06/27/1900	None					N/A
PM10 Colloc.									
PM2.5	Y	06/07/1900	02/01/1999	None					N/A
PM2.5 Colloc.									
PM2.5 Spec.									
TSP									
TSP Colloc.									
Lead									
Dichot									
TEOM	Y	03/31/1999	01/27/1999	None	n/a				N/A
BAM									
Temp	Y	06/09/1900	12/23/1999	None			N/A	N/A	N/A
%RH	Y	06/09/1900	02/18/1999	None			N/A	N/A	N/A
Baro	Y	06/09/1900	09/07/1999	None			N/A	N/A	N/A
WS HORIZ.	Y	06/09/1900	06/24/1999	None			N/A	N/A	N/A
WS VERTICAL									
WD	Y	06/09/1900	/ /	None			N/A	N/A	N/A
Solar									
Rain Gauge									
Toxics 920	Y	06/07/1900	04/21/1900	None					N/A
Carbonyl 925									
NMOC 910									
Wet/Dry Acid									
AISI Tape									
Nephelometer									

Figure 1.0.7.1 (cont.)
Preliminary Audit Report

Air Quality Data Accuracy Estimates

Gaseous Audit Results - All

Parameter	# of Audits	Avg % Diff.	Std. Dev.	95% UL	95% LL
OZONE	147	-2.5	3.7	4.8	-9.8
CARBON MONOXIDE	63	0.6	3.8	8.0	-6.8
SULFUR DIOXIDE	27	-1.2	4.8	8.1	-10.5
NITROGEN DIOXIDE	85	-3.3	4.3	5.2	-11.8
HYDROGEN SULFIDE	8	2.4	5.3	12.9	-8.1
METHANE	22	-1.1	5.2	9.0	-11.2
TOTAL HYDROCARBONS	15	1.3	8.4	17.7	-15.1
METHANE SB3	7	-5.0	3.6	2.1	-12.1
TOTAL HYDROCARBONS SB3	2	-2.9	1.9	0.8	-6.6
TOTAL NMOC SB3	11	-1.3	4.7	7.9	-10.5

Air Quality Data Accuracy Estimates

Particulate Audit Results - All

Parameter	# of Audits	Avg % Diff.	Std. Dev.	95% UL	95% LL
DICHOT	18	0.1	4.2	8.4	-8.2
TEOM	33	-1.4	2.9	4.4	-7.2
PM10 TOTAL 0-10UM	143	-0.3	3.1	5.9	-6.5
TOTAL SUSPENDED PARTICULATE	15	-1.5	4.8	7.9	-10.9
LEAD (TSP)	17	0.0	4.3	8.4	-8.4
BAM	3	-5.2	5.3	5.2	-15.6
PM2.5	93	-1.1	1.9	2.6	-4.8
PM10 PARTISOL	4	-3.1	2.8	2.5	-8.7

Air Quality Data Accuracy Estimates

Meteorological Audit Results - All

Parameter	# of Audits	Avg Diff.	Std. Dev.	95% UL	95% LL
OUTDOOR TEMPERATURE	78	0.0	0.2	0.5	-0.5
RELATIVE HUMIDITY	11	7.2	15.7	38.1	-23.7
WIND DIRECTION	83	-0.4	2.2	3.9	-4.7
VERTICAL WIND SPEED	7	0.0	0.1	0.2	-0.2
WIND SPEED	82	0.4	1.5	3.4	-2.6
BAROMETRIC PRESSURE	20	0.9	2.6	5.9	-4.1
SOLAR RADIATION	1	9.7	0.7	11.1	8.3

Figure 1.0.7.2
Final Audit Report

1999 Audit Distribution

1,063 Audits (after 49 AQDA deletions)

Instrument	# of Audits	% of Total Audits
O_3	147	13.8%
CO	63	5.9%
SO_2	27	2.5%
NO_2	85	8.0%
H_2S	8	0.8%
CH_4	22	2.1%
THC	15	1.4%
CH_4 (Hex)	7	0.7%
THC (Hex)	2	0.2%
Total NMOC	11	1.0%
Dichot	18	1.7%
TEOM	33	3.1%
PM_{10}	143	13.5%
TSP	15	1.4%
Pb	17	1.6%
BAM	3	0.3%
$PM_{2.5}$	93	8.7%
PM_{10} Partisol	4	0.4%
Ambient/Outdoor Temperature	78	7.3%
Relative Humidity	11	1.0%
Wind Direction	83	7.8%
Vertical Wind Speed	7	0.7%
Horizontal Wind Speed	82	7.7%
Barometric Pressure	20	1.9%
Solar Radiation	1	0.1%
PAMS (TTP)	17	1.6%
PAMS (Lab)	8	0.8%
Carbonyl	6	0.6%
Motor Vehicle Exhaust (Lab)	4	0.4%
Toxics Metals (Flow)	13	1.2%
Toxics (TTP)	16	1.5%
Toxics (Lab)	2	0.2%
Toxics Metals (Lab)	2	0.2%

Figure 1.0.7.2 (Cont.)
Final Audit Report

Table 12
1999 AQDAs by Agency

AGENCY CODE	AGENCY	# of AQDAs	#of Inst Audited*	#of Deletions	% of Inst Deleted
001	ARB	21	410	10	2%
009	Imperial County APCD	3	15	3	20%
013	Sacramento Metropolitan AQMD	6	58	5	9%
014	Mojave Desert AQMD	1	43	0	0%
019	Ventura County APCD	6	54	6	11%
022	Great Basin Unified APCD	2	50	1	2%
029	Mendocino County APCD	1	12	0	0%
032	Northern Sonoma County APCD	1	7	1	14%
033	Placer County APCD	1	7	1	14%
035	San Luis Obispo County APCD	1	25	0	0%
036	San Diego County AQMD	3	13	0	0%
037	Shasta County APCD	2	6	2	33%
050	North Coast Unified AQMD	1	5	0	0%
051	Northern Sierra AQMD	5	16	4	25%
061	South Coast AQMD	10	104	6	6%
069	San Joaquin Valley Unified APCD	7	85	6	7%
071	Antelope Valley APCD	2	10	0	0%
076	SEMARNAP (Mexico)	4	61	4	7%

** # of instruments audited includes instruments deleted*

Figure 1.0.7.2 (cont.)
Final Audit Report

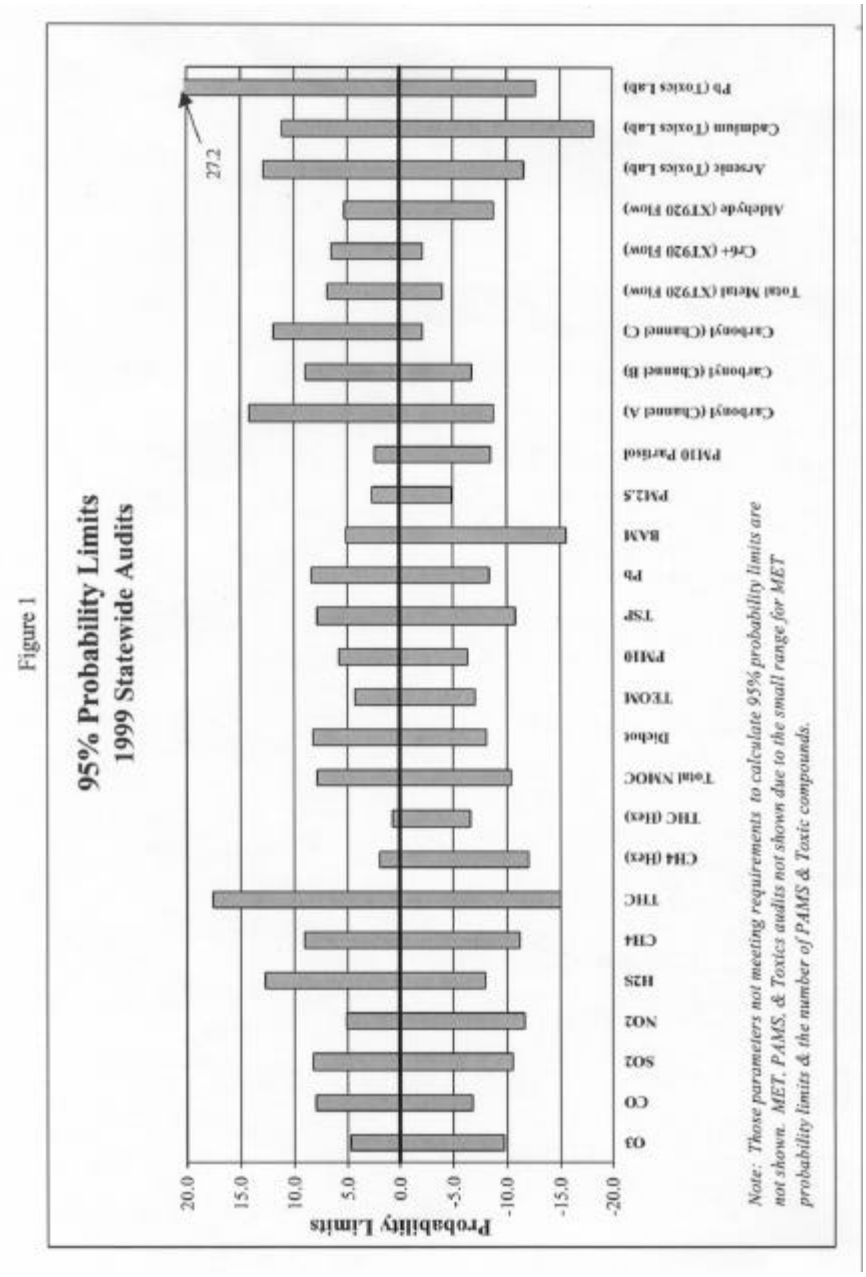


Figure 1.0.7.2 (Cont.)
Final Audit Report

MET Sensors Meeting PSD Standards

Pollutant/Sensor	# of Audits	# Meeting PSD Guidelines	% Meeting PSD Guidelines
Ambient Temp	78	76	97%
Relative Humidity	11	0	0%
Wind Direction	83	74	89%
Vert Wind Speed	7	6	86%
Horiz Wind Speed	82	75	91%
Barometric Pressure	20	20	100%
Solar Radiation	1	0	0%
Totals	282	251	89%

Figure 3
MET Audit Results

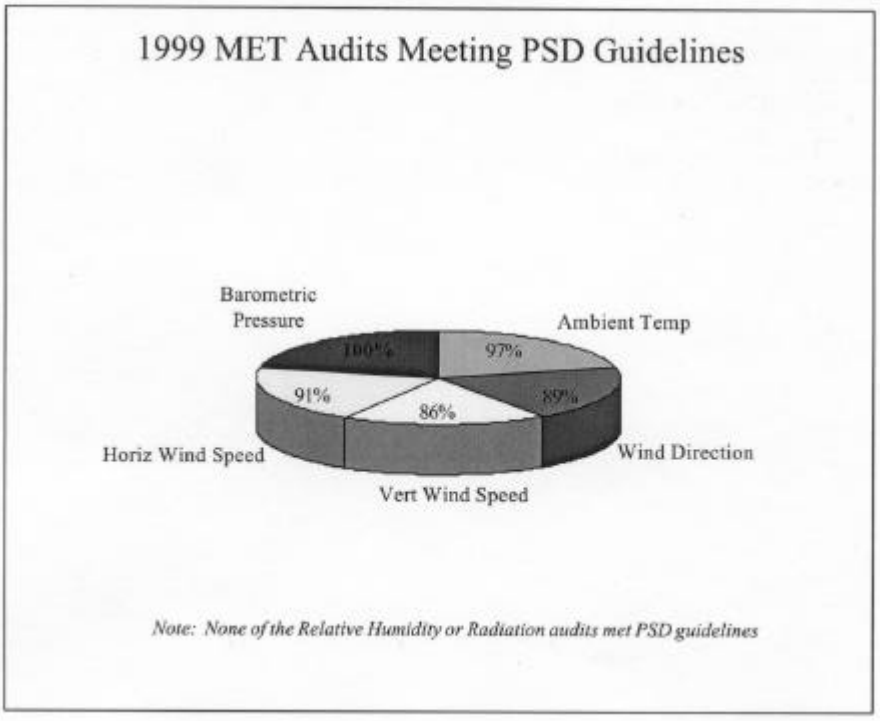


Figure 1.0.7.2 (Cont.)
Final Audit Report

Quality Assurance Thru-the-Probe Toxic VOC Audit Technical Appendix

Instrument/AIRS Information

ARB Number 31822 AIRS Number 060610006

Audit Date 01/14/99 Laboratory CALIFORNIA AIR RESOURCES BOARD

Audit Concentration Calculations

Diluted Conc. (ppbC) = True Conc. * Dilution Ratio

Percent Difference = (Average - Diluted Conc.)*100/Diluted Conc.

Audit Concentation versus Laboratory Response Data

Compound	True Conc. (ppbC)	Dilution Ratio	Diluted Conc. (ppbC)	Run 1 (ppbC)	Run 2 (ppbC)	Run 3 (ppbC)	Average (ppbC)	Percent Difference
Dichloromethane	764.00	1/101	7.56	8.51			8.51	*12.6%*
Chloroform	22.20	1/101	0.22	0.23			0.23	*4.5%*
1,1,1 Trichloroethane	265.00	1/101	2.62	2.68			2.68	*2.3%*
Carbon Tetrachloride	16.80	1/101	0.17	0.16			0.16	*-5.9%*
Benzene	261.00	1/101	2.58	2.80			2.80	*8.5%*
Trichloroethylene	92.20	1/101	0.91	1.09			1.09	*19.8%*
Toluene	514.00	1/101	5.09	4.50			4.50	*-11.6%*
Tetrachloroethylene	73.60	1/101	0.73	0.64			0.64	*-12.3%*
Chlorobenzene	90.80	1/101	0.90	0.60			0.60	*-33.3%*
Ethylbenzene	378.00	1/101	3.74	2.10			2.10	*-43.9%*
meta/para-Xylene	708.00	1/101	7.01	2.60			2.60	*-62.9%*
ortho-Xylene	85.10	1/101	0.84	0.30			0.30	*-64.3%*
Styrene	74.00	1/101	0.73					
m-Dichlorobenzene	132.00	1/101	1.31					
o-Dichlorobenzene	109.00	1/101	1.08					
1,2 Dibromomethane	15.30	1/101	0.15	0.18			0.18	*20.0%*
tert-Butyl methyl ether	293.00	1/101	2.90	2.70			2.70	*-6.9%*

California Air Resources Board
Monitoring and Laboratory Division
Quality Assurance Section

Figure 1.0.7.3
Toxics Through-the-Probe Audit Report

DATA PRECISION REPORT
DATA QUALITY ASSESSMENT REPORTING FORM

PRECISION

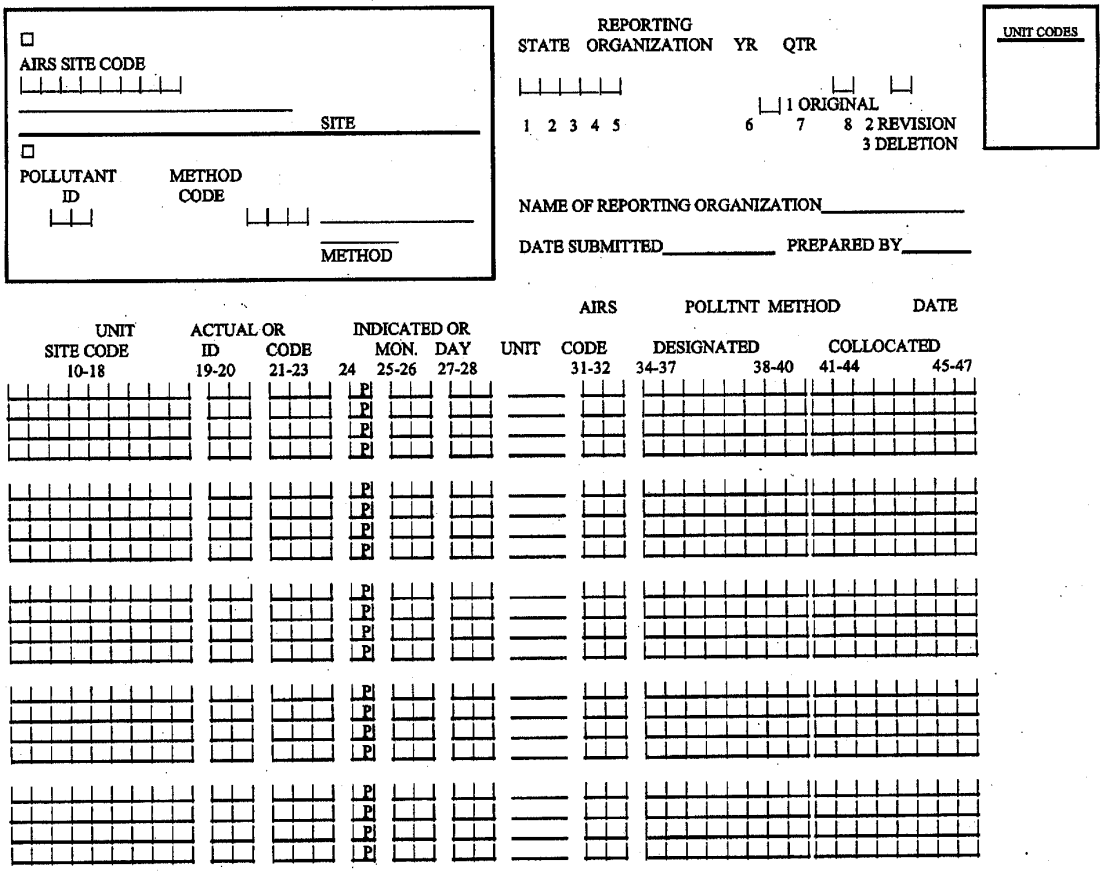


Figure 1.0.7.4
U.S. EPA Data Quality Assessment Reporting Form

Quality Assurance Agency Designation Codes

AGENCY CODE	AGENCY
001	California ARB
002	California Institute of Technology
003	Long Beach Department of Public Health
004	Bay Area AQMD
005	Needles City Hall
006	El Dorado County APCD
007	Fresno County APCD
008	Glendale Department of Public Service
009	Imperial County APCD
010	Los Angeles County APCD
011	Monterey Bay Unified APCD
013	Sacramento County APCD
014	Mojave Desert AQMD
015	San Francisco Health Department
016	San Joaquin County APCD
017	Santa Barbara County APCD
018	Santa Clara County Health Department
019	Ventura County APCD
020	Yolo-Solano APCD
021	Butte County APCD
022	Great Basin Unified APCD
023	Humboldt County APCD
024	Kern County APCD
025	Kings County APCD
026	Lake County APCD
027	Lassen County APCD
028	Madera County APCD
029	Mendocino County APCD
030	Merced County APCD
031	Modoc County APCD
032	Northern Sonoma County APCD
033	Placer County APCD
034	Riverside County APCD
035	San Luis Obispo County APCD
036	San Diego County AQMD
037	Shasta County APCD
038	Siskiyou County APCD
039	Stanislaus County APCD
040	Sutter County APCD
041	Tehama County APCD
042	Tulare County APCD
043	Toulumne County APCD
044	Yuba County APCD
045	Cool Water Coal Gasification Programs
046	Enviromental Monitoring Company (EMC)
047	Environmental Research Foundation
048	Pacific Gas and Electric (PG&E)
049	University of California-Riverside
050	North Coast Unified AQMD
051	Northern Sierra AQMD
052	XonTech, Inc.
053	Glenn County APCD
054	Amador County APCD
055	Calaveras County Health Departm
056	Colusa County APCD
057	Mariposa County APCD
058	Tracer Technologies
059	UNOCAL
060	TEXACO
061	South Coast AQMD
062	Chevron
063	Vandenberg AFB
064	EXXON
065	ERCE
066	ARCO
067	Shell
068	Feather River AQMD
069	San Joaquin Valley Unified APCI
070	POPCO
079	ATC
071	Antelope Valley APCD
073	WestSide Operators
076	SEMARNAP (Mexico)
077	OGDEN Engineering Systems
078	Desert Research Institute (DRI)
	USEPA Atmospheric Research ar
800	Assessment Lab
809	US EPA - Region IX
	US EPA/Human Studies Lab/Hea
812	Research Div
815	National Park Service (NPS)
819	US Forest Service
821	US EPA/OAQPS/MRB
908	Radian Corporation
909	Dames and Moore

Figure 1.0.7.5
Designation Codes

1.0.7.7 DATA ASSESSMENT CRITERIA FOR METEOROLOGICAL PARAMETERS

The QAS uses the criteria described below to determine the accuracies of various meteorological sensors. According to U.S. EPA Prevention of Significant Deterioration (PSD) Guidelines, accuracies and allowable errors for meteorological sensors are expressed as absolute errors for digital systems; errors in analog systems may be 50 percent greater. Audit results are currently described as meeting or not meeting the PSD guidelines listed below.

1. Horizontal Wind Speed and Wind Direction - Sensors should exhibit a starting threshold speed less than or equal to 0.5 meters per second (m/s) wind speed (at 10 degrees deflection for direction vanes). Wind speed sensors should be accurate above the starting threshold (0.5 m/s) to within 0.25m/s at speeds equal to or less than 5.0 m/s. At higher speeds, the error should not exceed 5 percent of the observed speed (maximum error not to exceed 2.5 m/s). The damping ratio of the wind vane should be between 0.4 and 0.65 and the distance constant should not exceed 5 meters. The error for wind direction sensors should not exceed 5 degrees, including sensor orientation error.

2. Vertical Wind Speed - Vertical wind speed sensors should exhibit a starting threshold speed less than or equal to 0.25 m/s. The required accuracy should be the same as horizontal wind speed.

3. Ambient Temperature - Errors should not exceed 1.0°C. If fog formation is a problem, errors should not exceed 0.5°C.

4. Humidity - Percent relative humidity values are converted to dew point temperature for error calculation. Errors in dewpoint temperature should not exceed 1.5°C over a dewpoint range of -30 to +30°C. If fog formation is significant, the error should not exceed 0.5°C.

1.0.7.8 DATA ASSESSMENT CRITERIA FOR BAM AND TEOM MONITORS

AQSB is currently performing quality control flow checks and comparisons of BAM and TEOM data against SSI/dichots for outliers. Further, the following interim procedures should be used for SLAMS and NAMS monitoring networks, as a part of and consistent with other data quality assessment requirements specified in 40 CFR 58, Appendix A.

1. General Quality Assurance - Quality assurance procedures described in the Operation or Instruction manual associated with each method should be implemented as completely as feasible. The use of calibration foils or standard filters is encouraged to the extent possible. Special care should be given to checking and recording the operational parameters of the instruments, since it may not be possible to verify these parameters in data output reports to printers or data processing systems.

2. Precision Assessment - Carry out a one-point check of each PM10 analyzer's normal operating flow rate at least once every two weeks using a flow rate transfer standard as described in Section 2.3.3 of Part 58, Appendix A.

   Care should be used in measuring the flow rate so that the flow measurement device does not alter the normal operating flow rate of the analyzer. If a precision check is made in conjunction with a zero or span adjustment, it must be made prior to such zero and span adjustment. Randomization of the precision check with respect to time of day, day of week, and routine service and adjustments is encouraged where possible.

   Report actual analyzer flow rate measured by the transfer standard and the corresponding flow rate measured or assumed by the analyzer. The percent differences between these flow rates are used to assess the precision of the monitoring data as described in Section 5.1 of Volume II of the U.S. EPA Quality Assurance Handbook, Appendix A (using flow rates in lieu of concentrations).

3. Accuracy Assessment - Each calendar quarter, audit the flow rate of at least 25 percent of the SLAMS PM10 analyzers such that each analyzer is audited at least once per year. If there are fewer than four PM10 analyzers within a reporting organization, randomly reaudit one or more analyzers so that at least one analyzer is audited each calendar quarter. Where possible, U.S. EPA strongly encourages more frequent auditing, up to an audit frequency of once per quarter for each SLAMS analyzer.

   The audit is made by measuring the analyzer's normal operating flow rate, using a flow rate transfer standard as described in Section 2.3.3 of Part 58, Appendix A. The flow rate standard used for auditing must not be the same

flow rate standard used to calibrate the analyzer. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Great care must be used in auditing the flow rate to be certain that the flow measurement device does not alter the normal operating flow rate of the analyzer. Report the audit flow rate and the corresponding flow rate indicated or assumed by the sampler. The percent difference between these flow rates are used to calculate accuracy as described in Section 5.4.1 of Volume II of the U.S. EPA Quality Assurance Handbook, Appendix A.

Portions of the guidance on flow rate standard devices and flow rate checks and audits for dichotomous PM10 samplers given in Section 2.10 of the U.S. EPA Quality Assurance Handbook, Volume II (EPA 600/4-77-027a) are applicable to the continuous PM10 analyzers. Copies of Section 2.10 can be obtained from the Aerosol Physics and Methods Branch or may be downloaded (without figures) from the AMTIC electronic bulletin board. For the TEOM, the actual instrument flow rate (nominally 3.0 liters/min) should be measured and reported for precision and accuracy. The total flow rate (nominally 16.7 liters/min) should be checked to verify that it is within the $\pm$10 percent tolerance specified for the PM10 inlet, but total flow rates should not be reported for precision or accuracy. Also, results from accuracy audits using calibration foils or standard filters should not be reported for accuracy until definitive procedures are established.

1.0.7.9 DATA ASSESSMENT CRITERIA FOR AMBIENT TOXICS DATA

Field performance audits of the XonTech 920 Toxic Air Sampler are conducted annually by QAS staff. The purpose of the audit is to assure the flow accuracy of each sampling channel in the sampler. The audit is conducted by comparing the indicated flow on each sampling channel against the true flow as measured by a certified flow transfer standard. The audit procedure is detailed in Appendix L of Volume V of the QA Manual. Flow limits are $\pm$10 percent.

Laboratory performance audits of the Toxic Air Contaminants (TAC) Program are performed semiannually by QAS staff. The purpose of the audits is to assess the accuracy of the methods used by the laboratories to measure ambient concentrations of TACs. The audits are conducted by supplying each laboratory with a cylinder containing a mixture of standards certified by NIST. The laboratory analyzes the contents of the cylinder following standard operating procedures, and reports the results

of the analyses to QAS. QAS, in turn, calculates the percent biases of the results and reports the final audit results to the laboratory. Control limits on percent biases depend on the individual compound measured and can vary from ±10 percent to ±50 percent. The list of TACs that may be in the audit cylinders is contained in the audit procedure, Appendix M of Volume V of the QA Manual.

Field performance audits of the XonTech 910A Toxic Air Sampler are conducted annually by QAS staff by collecting known concentrations of TACs (using a NIST cylinder and diluting to ambient concentrations) through-the-probe into Summa canisters. The purpose of the audits is to assess the accuracy of the total measurement system, including laboratory error. The laboratory analyzes the contents of the canister and reports the results to QAS. QAS then calculates the percent differences and reports the final results to the laboratory. The control limits on percent differences have not yet been established. The list of TACs contained in the canister is shown in Figure 1.0.7.3.

1.0.7.10 DATA ASSESSMENT CRITERIA FOR NON-METHANE HYDROCARBONS IN AMBIENT AIR

Laboratory performance audits of the non-methane hydrocarbons program are performed annually by the QAS staff. The purpose of the audits is to assess the accuracy of the methods used by the laboratories to measure ambient concentration of non-methane hydrocarbons. The audits are conducted by supplying each laboratory with a cylinder containing a mixture of standards certified by the National Institute of Standards and Technology (NIST). The laboratory analyzes the contents of the cylinder following standard operating procedures, and reports the results of the analyses to QAS. QAS, in turn, calculates the percent differences of the results and reports the final audit results to the laboratory. Control limits on percent biases are ±20 percent.

Field performance audits of the NMHC program are conducted annually by QAS staff by collecting known concentrations of NMHCs (using NIST cylinder and diluting to ambient concentrations) through-the-probe into Summa canisters. The purpose of the audits is to assess the accuracy of the total measurement system, including laboratory error. The laboratory analyzes the contents of the canister and reports the results to QAS. QAS, in turn, calculates the percent biases and reports the final results to the laboratory. The control limits on percent bias have been set at ±20 percent for each compound.

1.0.7.11 DATA ASSESSMENT CRITERIA FOR NON-METHANE HYDROCARBONS IN MOTOR VEHICLE EXHAUST

Laboratory performance audits of the NMHC motor vehicle exhaust program are performed annually by the QAS. The purpose of the audits is to assess the accuracy of the methods used by Southern Laboratory Branch to measure the concentrations of non-methane hydrocarbons. The audits are conducted by supplying each laboratory with a cylinder containing a mixture of standards certified by NIST. The laboratory analyzes the contents of the cylinder following standard operating procedures, and reports the analyses results to QAS. QAS, in turn, calculates the percent differences of the results and reports the final audit results to the laboratory. Control limits on percent differences are $\pm$20 percent for each compound.

1.0.8 DOCUMENT CONTROL AND REVISIONS

1.0.8.1 INTRODUCTION - A quality assurance program includes a system for documenting and revising procedures. The system used for these volumes essentially follows that described in U.S. EPA's Quality Assurance Handbook for Air Pollution Measurement Systems; (Volume I, EPA-600/9-76-005).

1.0.8.2 DISCUSSION OF DOCUMENT CONTROL - A quality assurance program includes a system for updating formal documentation of operating procedures. The documentation used in the Air Resources Board's Quality Assurance volumes are described herein. The system uses a standardized indexing format and provides for convenient replacement of pages that may be changed within the technical procedure descriptions. The indexing format includes, at the top right of each page, the following information:

Volume
Section
Revision
Date (of revision)
Page

The "Volume" identifies the specific volume in the ARB series. The "Section" identifies major three-place sections. "Revision" represents the most current version of the section (the first version is represented as "0"). "Date" represents the date of the current revision. "Page" includes both the number of the specific page, and the total number of pages in the section. An example of the page label follows:

Volume I
Section 2.0.2
Revision 0
January 1, 1990
Page 1 of 6

For each three-place section, the text begins on a new page. This format groups the pages together to allow convenient revision. Each time a new page is added or expanded within a section, the number of the preceding or original page is included on the new page, and a letter is added to it. For example, if Page 4 of 8 were revised and

expanded to include an extra paragraph, the overflow would appear on a page designated 4a. The original Page 4 would then be removed from the Manual and replaced by revised Page 4 and Page 4a. This allows expansion within a section without retyping the section or renumbering all the pages. The pages would be designated Page 4 of 8 and Page 4a of 8 even though there would actually be nine pages.

The Table of Contents follows the same structure as the text. It contains a space for "Revision" and "Pages" within each section heading. When a revision to the text is made, the Table of Contents pages are updated by either retyping, or striking out the old revision number and printing the current revision number. For example, a Table of Contents page might appear as follows:

		Pages	Revision	Date
A.1.0	GENERAL INFORMATION	3	1	01-01-90
A.1.1	ROUTINE SERVICE CHECKS	5	1	01-01-90
A.1.2	DETAILED MAINTENANCE PROCEDURES	5	1	01-01-90

A revision to "ROUTINE SERVICE CHECKS" would change the Table of Contents to appear as follows:

		Pages	Revision	Date
A.1.0	GENERAL INFORMATION	3	1	01-01-90
A.1.1	ROUTINE SERVICE CHECKS	5	2	02-15-90
A.1.2	DETAILED MAINTENANCE PROCEDURES	5	1	01-01-90

When numbering and titling three- and four-place sections, adhere to the following procedure:

1. Three-place section number(s) designate section titles; i.e., A.2.0 or 1.0.1. They are aligned on the left-hand margin with the section title written in capital letters and bold type, 10 spaces to the right of the left-hand margin.

2. Four-place number(s) are used to designate major topics in sections; i.e., A.2.0.1 or 1.0.1.1. They are aligned on the left-hand margin with the section topic capitalized, underlined, and tabbed 10 spaces to the right of the left-hand

margin. Information pertaining to the section is aligned with the first word after the four-place number.

3. Five-place number(s) are used to designate section sub-topics; i.e., A.2.0.1.1 or 1.0.1.1.1. They are aligned on the left-hand margin with the section sub-topic first letters capitalized, and tabbed 15 spaces to the right of the left-hand margin. Information pertaining to the section is aligned with the first word after the five-place number.

4. First number(s) are used to designate information pertaining to sub-topics. The number(s) are indented 10 spaces from the-left hand margin. Information is tabbed 15 spaces from the left-hand margin with following sentences aligned with the first word after the number.

5. First letter(s) are used to further explain sub-topics. They are lower case and indented 15 spaces from the left-hand margin. Information contained follows 20 spaces from the left-hand margin, with following sentences aligned with the first word after the letter.

1.0.8.3 DISTRIBUTION RECORD CARD - A distribution record has been established and is maintained so that future revisions and additional new sections may be distributed to users. In order to enter the user's name in the distribution system, the "Distribution Record Card" must be filled out and mailed to the address listed on the card. Each volume of the Quality Assurance Manual contains a separate "Distribution Record Card". The current distribution list is available upon request to the Air Resources Board's Monitoring and Laboratory Division, Quality Assurance Section.

1.0.9 REFERENCES

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3. Ibid, Guidelines for Development of a Quality Assurance Program, Reference Method for the Determination of Suspended Particulates in the Atmosphere (High Volume Method), EPA-R4-73- 028b, U.S. EPA, June 1973.

4. Ibid, Guidelines for Development of a Quality Assurance Program, Reference Method for Measurement of Photochemical Oxidants, EPA-R4-73-028c, U.S. EPA, June 1973.

5. Ibid, Guidelines for Development of a Quality Assurance Program, Reference Method for the Determination of Sulfur Dioxide in the Atmosphere, EPA-R4-73-028d, U.S. EPA, August 1973.

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18. J. Horrocks to R. Torre, "Calcium ion analysis for acid rain samples," CARB internal memorandum, Sept. 16, 1988.

19. G. J. Stensland and V. C. Bowersox, "Quality assurance in acid precipitation monitoring through the use of ion balance calculations," in Transactions A.P.C.A. Specialty Conference on Quality Assurance in Air Pollution Measurements, A.P.C.A., 1984, pp. 425-443.

20. Air Monitoring Quality Assurance, Volume II, Standard Operating Procedures for Air Quality Monitoring, California Air Resources Board, January 1989, Section 2.0.2.8.